FINAL

WORK PLAN
FOR
SOUTH CAVALCADE STREET
HOUSTON, TEXAS
REMEDIAL INVESTIGATION/FEASIBILITY STUDY

001217

April 4, 1985

****

COMPANY CONFIDENTIAL

****

This Work Plan, prepared by the REM II Team in accordance with the items of USEPA Contract No. 68-01-6939, is Company Confidential

Work Assignment No.: 46-6L56

Document No.: 143-WP1-WP-ATEW-3

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CDM
environmental engineers, scientists, planners, & management consultants

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April 4, 1985

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Project: REM II - EPA Contract No. 68-01-6939/143/WP1

Document No.: 143-WP1-WP-ATEW-3

Subject: Work Plan
South Cavalcade Street
Houston, Texas

Dear Mr. Nott and Mr. Cochran:

Camp Dresser & McKee Inc. (CDM) is pleased to submit this Work Plan for the South Cavalcade Street Site. It consists of two volumes: Volume 1 is the technical portion of the Work Plan; Volume 2 contains the costs. These costs are estimates, and they assume the use of outside, private analytical laboratories and subsurface contractors approved for Basic Ordering Agreements under our REM II contract.

These two volumes of the Work Plan are accompanied by three other documents: an Interim Site Characterization Report, a Site Plan, and a Project Operations Plan (POP). This makes a complete package. Only the technical portion of the Work Plan and the Site Plan have been revised from the draft documents submitted February 22, 1985.

Call us if you have comments or questions.

Sincerely,

CAMP DRESSER & McKEE INC.

Robert S. Kier, Ph.D.
Site Manager

CAMP DRESSER & McKEE INC.

William F. Buchholz, Jr., P.E.
Region VI Manager

RSK/WFB/mem

PERFORMANCE OF REMEDIAL RESPONSE
ACTIVITIES AT UNCONTROLLED HAZARDOUS
WASTE SITES (REM II)

U.S. EPA CONTRACT NO. 68-01-6939

WORK PLAN
FOR
SOUTH CAVALCADE STREET SITE

HOUSTON, TEXAS

EPA Work Assignment No.: 47-6L56
REM II Document No.: 143-WP1-WP-ATEW-3

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Jonathan G. Curtis, P.E.
Finance & Administration Manager

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AF2-52/1

WORK PLAN APPROVAL

SPM

DATE: ______________________

FROM: John Cochran
Regional Site Project Officer

TO: ______________________
REM-Deputy Project Officer

WA NO.: 46-6L56

SITE NAME: South Cavalcade Street

ACTIVITY: Remedial Investigation
Feasibility Study

INSTRUCTIONS FOR PROCESSING "WORK PLAN APPROVAL"

1) SPM initiates and submits form to RSPO.
2) RSPO completes form, gets REM-RPO signature and returns form to SPM
3) SPM forwards completed form to ZPMO (Attn: AZPM-Admin)
4) ZPMO delivers form to EPA HQ.
5) EPA HQ processes/approves form and returns to ZPMO.
6) ZPMO notifies SPM of approval.

RSPO

___ Approval for entire work plan:

Budget $ ______________

LOE Hours ______________

Estimated Completion Date ______________

___ Partial approval:

Tasks Approved ______________

Budget $ ______________

LOE Hours ______________

___ Not approved:

COMMENTS: ____

RSPO Signature/Approval/Date

REM-RPO Signature/Approval/Date

EPA HQ

___ Approved as submitted
___ Approved with changes
___ Approved pending funding
___ Partial approval
___ Not approved

REM- PO Approval Signature/Date

___ Approved as submitted
___ Approved with changes
___ Approved pending funding
___ Partial approval
___ Not approved

CO Authorization Signature/Date

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EXECUTIVE SUMMARY

This Work Plan describes the tasks to be performed for the Remedial Investigation and the Feasibility Study (RI/FS) at the South Cavalcade Street Site, Houston, Texas. The Work Plan has been prepared by Camp Dresser & McKee Inc. (CDM) in accordance with the U.S. Environmental Protection Agency's Work Assignment No. 46-6L56 under the REM II - EPA Contract No. 68-01-6939/143/WP1. The principal purpose of the Remedial Investigation is to characterize the South Cavalcade Street Site in terms of the nature and the extent of contamination and its threat to human health and the environment. The Feasibility Study is the process of identifying, evaluating, and selecting the most feasible remedial alternative in accordance with accepted standards.

The Work Plan has been prepared based on available information for the South Cavalcade Street Site. The focus of the Work Plan is on the additional information and the evaluations needed to provide a basis for selecting the most cost-effective remedial alternative for the South Cavalcade Street Site that responds to the established response objectives. Supporting documents that have been prepared by CDM include the "Interim Site Characterization Report" and "Site Plans" for the South Cavalcade Street Site.

A fundamental assumption underlying the preparation of the Work Plan is that the RI/FS will be performed by a Potential Responsible Party, Koppers Company, Inc. (Koppers) of Pittsburgh, Pennsylvania, and its subcontractors. Oversight of the RI/FS will be performed by the U.S. Environmental Protection Agency (EPA) and its contractors to assure conformance with the Work Plan and the Remedial Action Objectives.

National Lumber and Creosoting Company began wood preserving and wood treating operations on the site in 1911. Aerial photos of the site show that the processing/treatment facilities were concentrated in parts of the southern portion of the site, with wood storage yards occupying the remaining parts of the southern and central portions of the site. The northern portion of the site appears to have been left vacant.

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In 1940, Koppers acquired the site from National Lumber and Creosoting Company and continued operations until 1961. The Koppers operation on the site involved both creosoting and metal-salt wood processing in the same locations as those used by National Lumber and Creosoting. However, Koppers added a coal tar distillation plant on the east side of the site.

After ceasing operations on the South Cavalcade Street Site, Koppers dismantled the wood treating and coal tar distillation facilities and sold the site to Merchants Fast Motor Lines (Meridian Transport Company). Merchants retained ownership of the western half of the southern portion of the site, where they constructed a palletized trucking warehouse, and the central third of the site, which they left undeveloped. The western half of the southern portion of the site was sold to Rex King and is used by Palletized Trucking, Inc. The northern portion of the side was sold to the Baptist Foundation of Texas; Transcon Trucking Lines and AJF Leasing currently lease portions of this tract. The area surrounding the site has been developed principally for industrial and commerical use on the south, east, and north sides. The east side of the site is bounded by a distribution center for Mobil Oil Company and by low-income residential development.

In early 1983, the Harris County Metropolitan Transit Authority (MTA), through the Houston Transit Consultants (HTC) investigated the potential for developing the site as a railyard, shop, and terminal facility for its proposed METRO-Stage One Regional Rail System. During the course of routine preliminary geotechnical investigations, McClelland Engineers, Inc. (MEI) detected indications of probable contamination. The Texas Department of Water Resources (TDWR) was notified and began an investigation. At the same time, MTA through HTC and MEI retained Camp Dresser & McKee Inc. (CDM) to perform a comprehensive contaminant survey. Shortly after the survey was initiated, however, the bond referendum necessary for the continued development of the Houston Regional Rail System failed, and further work was cancelled. Although CDM's work was incomplete, their three volume report, "Cavalcade Contaminant Survey", dated July 11, 1983, nevertheless provides the most detailed documentation of the nature and extent of contamination at the South Cavalcade Street Site.

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In April 1984, TDWR recommended the South Cavalcade Street Site for inclusion on the updated National Priority List (NPL) with a Hazard Ranking of 38.7. In response to initiatives by TDWR, Koppers retained MEI to perform further site investigations. A MEI report, dated May 8, 1984, presents the results of that study. On October 2, 1984, the site was placed on the NPL. CDM was assigned the site as EPA's contractor, under the REM II program in December, 1984.

The Work Plan details a total of sixteen tasks to be performed in carrying out the Remedial Investigation and the Feasibility Study at the South Cavalcade Street Site. These tasks are as follows:

TASK 0 - Develop Work Plan
TASK 1 - Compile and Evaluate Background Information
TASK 2 - Perform Field Investigations
TASK 3 - Perform Endangerment Assessment
TASK 4 - Prepare Immediate Remedial Investigation Report
TASK 5 - Prepare Draft Remedial Investigation Report
TASK 6 - Prepare Final Remedial Investigation Report
TASK 7 - Develop Remedial Alternatives
TASK 8 - Screen Remedial Alternatives
TASK 9 - Perform Laboratory Studies/Pilot Testing
TASK 10 - Evaluate Remedial Alternatives
TASK 11 - Develop Conceptual Design
TASK 12 - Prepare Draft Feasibility Study Report
TASK 13 - Prepare Final Feasibility Study Report
TASK 14 - Perform EPA Designated Activities
TASK 15 - Reporting and Management

The overall schedule for performing the Remedial Investigation and the Feasibility Study is twenty months. The bulk of the work necessary to complete Task 0 has already been performed in the development of the Work Plan document, Interim Site Characterization Report, and the Site Plans. The only remaining portions of Task 0 to be performed are the development of company- and site-specific health and safety plans, quality assurance and quality control plans, field sampling and analytical plans, and a site management plan. Preparation of these plans by Koppers, subject to review and approval (as appropriate) by EPA, are requisite to commencing onsite work.

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1.0 INTRODUCTION

This Work Plan describes the tasks to be performed for the Remedial Investigation and the Feasibility Study (RI/FS) at the South Cavalcade Street Site in Houston, Texas. The Work Plan has been prepared by Camp Dresser & McKee Inc. (CDM) in accordance with EPA's Work Assignment No. 46-6L56. The underlying premise of the Work Plan is that the RI/FS work at the South Cavalcade Street Site will be performed by a Potential Responsible Party, Koppers Company, Inc. (Koppers) of Pittsburgh, Pennsylvania, and its subcontractors. Oversight of the RI/FS work will be performed by the U.S. Environmental Protection Agency (EPA) and its contractors to assure conformance with the Work Plan and the Remedial Action Objectives.

The Work Plan has been prepared based on the available data for the South Cavalcade Street Site. The principal purpose of a Remedial Investigation is to characterize the site in terms of the nature and the extent of contamination at the site and its threat to human health and the environment. The Feasibility Study is the process of identifying, evaluating, and selecting the most feasible remedial alternative in accordance with the National Contingency Plan.

The Work Plan focuses on gathering and evaluating the information needed to provide a basis for selecting one or more remedial alternatives for the site. Coordination with other documents produced in parallel with the Work Plan is essential. The first of these documents, prepared by CDM, is an Interim Site Characterization Report, containing a detailed description of the site, its location, history of operations, previous investigations, and remedial actions taken to date and of the nature of the problem. Also included in the Interim Site Characterization Report are the results of the Initial Site Investigation. The second document is the accumulated group of Site Plans, graphically presenting the current and historic use of the site, localities where samples have been obtained in the past, and the proposed sampling localities, in an integrated fashion for easy reference. The Site Plans also have been prepared by CDM, but modifications or addenda to the Site Plans are anticipated during the course of the Remedial Investigation.

An additional document or set of documents addressing the following must be prepared:

- Health and safety plans, governing all on-site investigations;
- Quality assurance and quality control plans, governing all on-site work, laboratory analyses, work conducted by outside contractors and data validation;
- Field sampling and analyses plan, governing specific procedures for the collection of samples and for the laboratory analyses and the disposal of all excess materials;
- Site management plan, detailing site operations and site security, and including contingency plans; and
- Data management plan, containing the basic guidelines for recording and preserving data.

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The Project Operations Plan (POP), prepared by CDM is provided as an example. The POP is a combination of site specific health and safety plans, quality assurance and qualty control plans, and sampling and analytical plans. It is a basic guidance document for all field and analytical activities as well as quality assurance throughout the RI/FS work. Koppers shall be responsible for production of the pertinent plans governing their work and shall present those plans for review and approval by EPA prior to initiating onsite investigations.

2.0 BACKGROUND

2.1 SITE LOCATION AND HISTORY

2.1.1 SITE LOCATION

The South Cavalcade Street Site is located within the incorporated boundaries of the City of Houston, Texas, the state's largest city and the fifth largest in the nation.

The site covers about 69 acres in northeast Houston, about one mile southwest of the intersection of Interstate Loop 610 North and U.S. Route 59 (Figure 2-1). The site is bounded on the north by Cavalcade Street, to the south by Collingsworth Street, on the west by the Houston Belt and Terminal (HB&T) Railroad Passenger Main and Maury Street, and on the east border by the HB&T Freight Main (now the Missouri and Pacific R.R.).

2.1.2 SITE PLAN

The present land use of the South Cavalcade Street Site is predominately commercial, made up of several trucking firms. A southern tract of about 28.3 acres, facing onto Collingsworth Street to the south, is presently occupied by the Merchants Fast Motor Lines (14.9 acres in the ownership of Meridian Transport Company) on the southwest side of the tract, and 13.4 acres to the south east owned by Rex King and occupied by Palletized Trucking, Inc.

A central tract of some 18.2 acres is also owned by the Meridian Transport Company and is presently idle (undeveloped) land. The 22.5-acre northern tract is owned by the Baptist Foundation of Texas and presently occupied by the Transcon Trucking Lines and AJF Leasing, Inc. The northern tract accesses to the north onto Cavalcade Street. Figure 2-2 displays the present property ownership of the site.

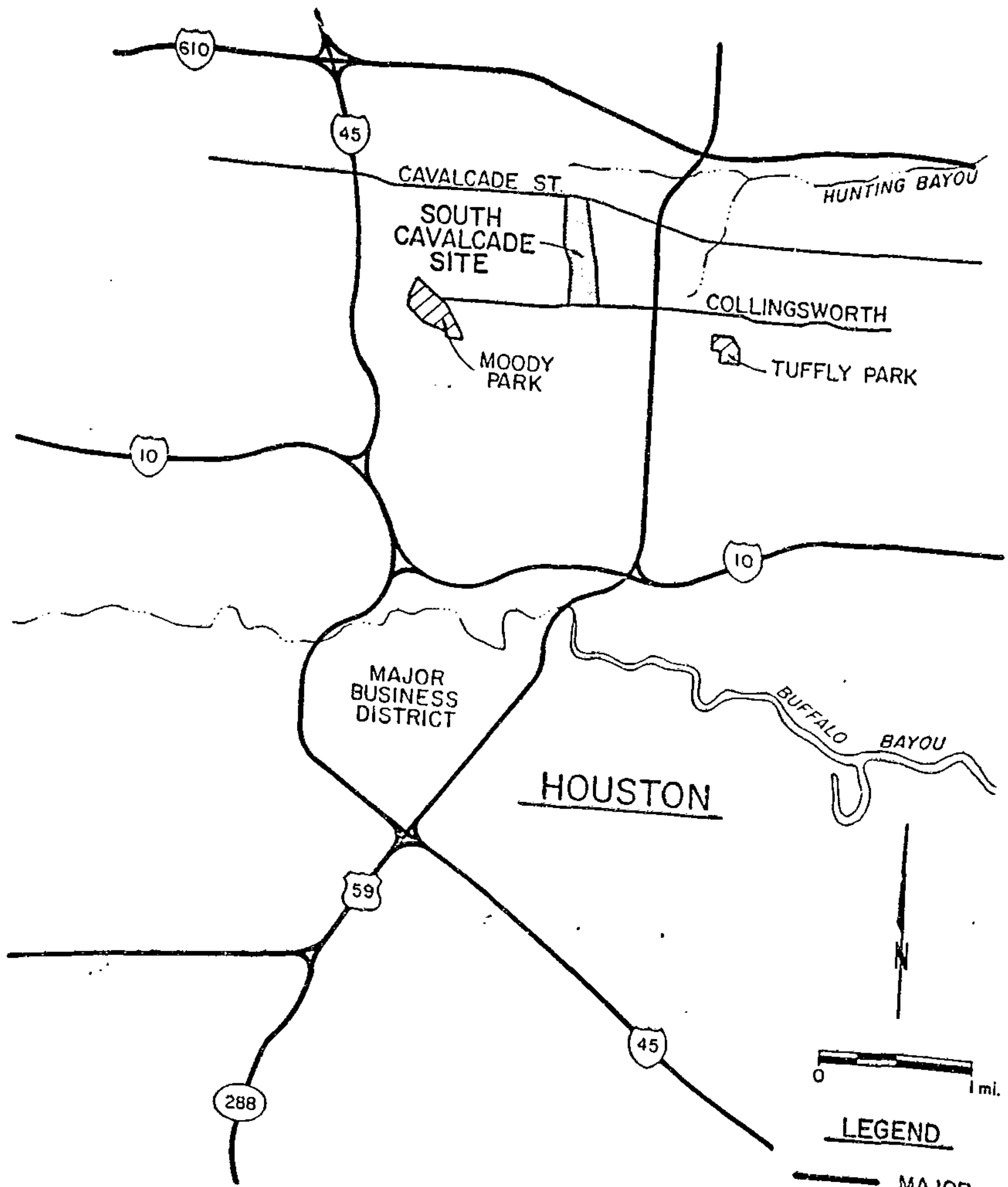

FIGURE 2-1
SITE LOCATION MAP

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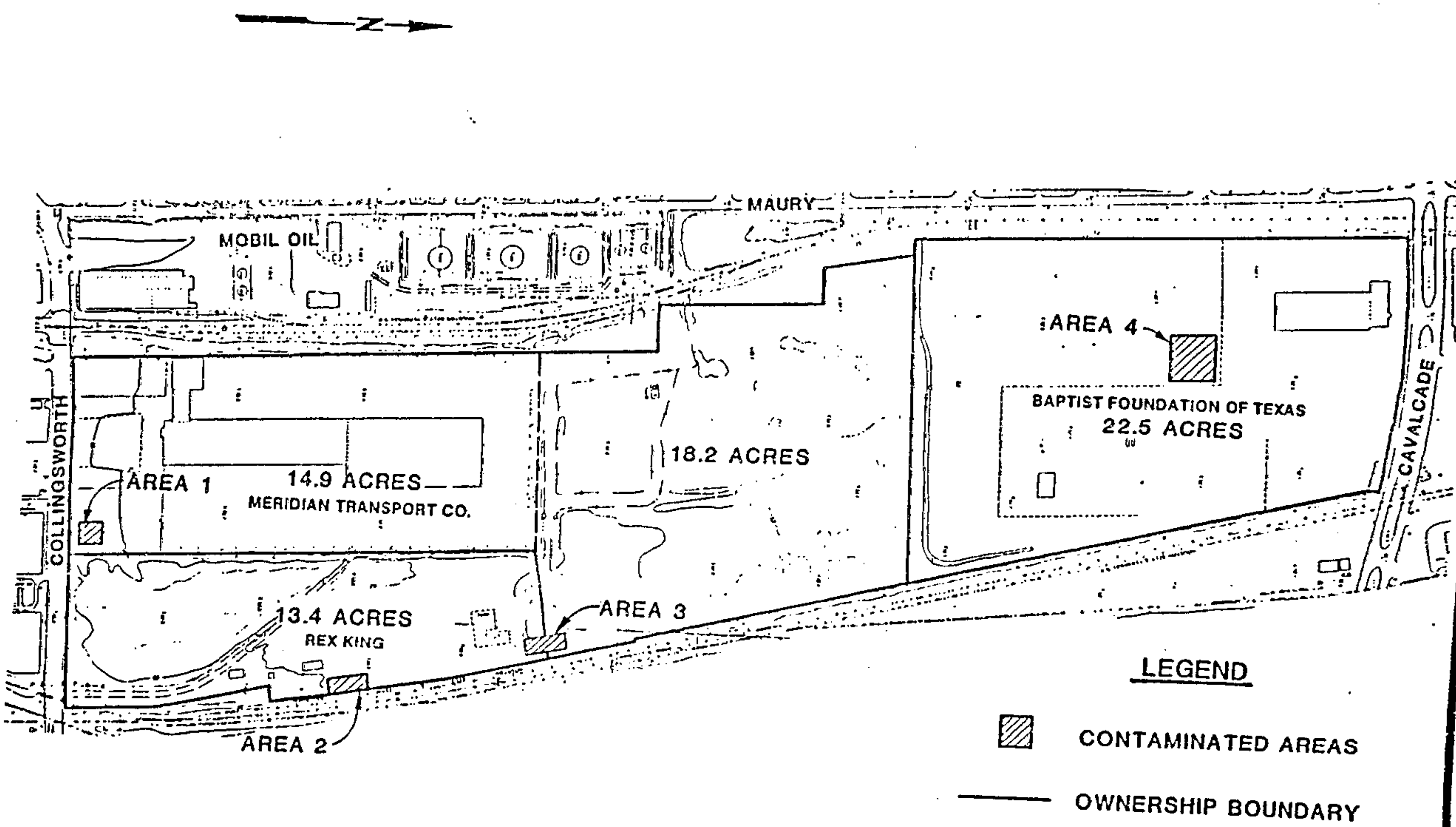

FIGURE 2-2
PRESENT OWNERSHIP & USE WITH CONTAMINATION AREAS

CAMP DRESSER & MCKEE INC.

2.1.3 HISTORY OF SITE

The South Cavalcade Street Site has a 70+ year history of industrial/commercial use with potential for long-term contaminant pollution of the site. "Cavalcade Contaminant Survey", a report in three volumes by Camp Dresser & McKee, Inc. dated July 11, 1983, first documents the general nature and extent of site pollution. Subsequently, the site was designated by the U.S. Environmental Protection Agency (EPA) as a hazardous waste site on the National Priority List (NPL) with a Hazardous Ranking Score (HRS) of 38.7.

The National Lumber and Creosoting Company (NLCC) operated a wood-treatment facility on the site from 1911 to 1939. An early aerial photo of the site (1933) indicates the actual wood processing/treatment facilities used by the NLCC were concentrated in the southern end of the site along Collingsworth Street, with wood storage yards occupying the remaining southern and central parts of the site and vacant (idle) lands in the northern third. A neighboring commercial development of about three acres, immediately across the Houston Belt and Terminal (HB&T) railroad main to the west of the site, and also fronting on Collingsworth Street, shows on the 1933 photo as well. This property is identified at a later (and expanded acreage) stage as a Mobil Oil Company products distribution center (wholesale).

In 1940, the Koppers Company, Inc. (KCI) acquired the property from NLCC and operated a wood treating facility and coal tar distillation facility on the site from 1940 to 1961. Aerial photos of the site during the period of KCI operations (1944 and 1953) indicate only minor changes in site development or use from the 1933 photo. The 1953 aerial photograph shows an expansion of the Mobil Oil Company operations across the tracks west of the site to about 10 acres, including the addition of a tank battery and rail siding at the north end of the Mobil site approximately 1,000 feet north of Collingsworth Street. Also, by 1953 some commercial development had begun just to the north of the South Cavalcade Site. Although not confirmed through deed records, interviews with early Koppers Company personnel, previous owners and local residents indicate the probability of a smaller

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scale wood treatment operation just north of the present-day Cavalcade Street in the early 1950's.

The KCI property south of the present-day Cavalcade Street was transferred by recorded deed to Merchants Fast Motor Lines (Meridian Transport Company) in 1962. The property was subsequently subdivided into three ownership tracts, as shown previously on Figure 2-2. A northern portion of about 22.5 acres was transferred to the Baptist Foundation of Texas. This tract has been leased and developed by the Transcon Trucking Lines, with a sublease to AJF Leasing, Inc.

A central tract of about 18.2 acres remains in the ownership of the Meridian Transport Company and is presently undeveloped and idle. The southern tract of about 28.3 acres was subdivided into two tracts after its acquisition by Meridian Transport Company in 1962. The southeastern 13.4 acres is owned by Rex King and presently used by Palletized Trucking, Inc. The southwestern tract of 14.9 acres remains in the ownership of Meridian Transport Company and is developed for use of the Merchants Fast Motor Lines.

2.1.4 HISTORY OF RESPONSE ACTIONS

The Houston Metropolitan Transit Authority (MTA), as part of its proposed METRO-Stage One Regional Rail System (RRS) study, investigated the feasibility of including the property designated in this report as the South Cavalcade Street Site as a yard, shop and terminal facility for the RRS. Under contract to the Houston Transit Consultants (HTC), prime contractor to the MTA, the firm McClelland Engineers, Inc. (MEI) was selected to perform a geotechnical investigation of the site. During the course of that investigation, observations were made of probable contamination of the site with toxic waste materials from previous commercial or industrial areas.

At that time (early 1983), the state agency responsible for hazardous waste control, the Texas Department of Water Resources (TDWR), was notified of the probable contamination of the site. The TDWR then initiated the

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state's process of investigation to determine the nature and extent of the problem, the present and prior ownership and use of the site, and the possibility of voluntary compliance with remedial clean-up operations at the site.

At the same time, the Houston MTA, acting through HTC and its geotechnical consultant MEI, contracted with the environmental engineering and consulting firm Camp Dresser & Mckee Inc. (CDM) to perform a comprehensive contaminant survey of the site. A three volume CDM report entitled "Cavalcade Contaminant Survey", dated July 11, 1983, provided the first detailed assessment of the extent and nature of hazardous contamination at the Cavalcade Site.

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In April, 1984, the TDWR recommended the site to the U.S. Environmental Protection Agency (EPA) for inclusion on the National Priority List (NPL) of hazardous waste sites. On October 2, 1984, the South Cavalcade Site was placed on the NPL, with EPA taking the lead responsibility for subsequent RI/FS efforts. The site has been assigned a Hazardous Ranking System score of 38.7 on the NPL.

In response to initiatives by the TDWR to secure remedial measures by previous owners of the site, the Koppers Company, Inc. (KCI) of Pittsburgh, Pennsylvania contracted with the Houston geotechnical consultants McClelland Engineers, Inc. (MEI) to perform further site investigations. An MEI report to KCI, dated May 8, 1984, presents the results of that site study. Subsequently, KCI contracted with the firm Environmental Research and Technology, Inc. (ERT) of Pittsburgh, Pennsylvania to propose a work plan for a RI/FS study on Koppers former Cavalcade Plant Site. A draft "Proposed Work Plan, Remedial Investigation/Feasibility Study, Koppers Company, Inc. Former Cavalcade Plant Site, Houston, Texas" dated December 13, 1984, presents a proposed RI/FS program for the Koppers Company.

In December, 1984, the U.S. EPA authorized a work assignment for an RI/FS on the South Cavalcade Street Site to CDM under project REM II - EPA Contract No. 68-01-6939/143/WP1, Document Control No. 143-WP1-WA-ANNM-1. A

Work Plan Memorandum by CDM for RI/FS on the South Cavalcade Street Site, dated December 31, 1984, has been submitted to the EPA.

2.2 CONTAMINATION PROBLEM

2.2.1 PHYSIOGRAPHY

The general physiography of the site is a relatively flat plain with a very gentle slope to the south and east. Elevations range from about 50.0 feet (mean sea level) on the south to about 52.1 feet msl along Cavalcade Street to the north, an average slope of less than 0.15 percent. Drainage is generally to the south and east to local tributaries of Buffalo Bayou (and the Houston Ship Channel).

Soils

Local soil conditions have previously been investigated at the South Cavalcade Site (see McClelland Engineers Report No. 0182-0282, Volume II, dated May 20, 1983). A generalized soil profile of the site shows four distinct soil strata. Figure 2-3 depicts the soil conditions throughout the site based on reconnaissance borings. Although there are variations in strata elevation and thickness, the following generalized soil strata appear to the present throughout the site.

Strata	Depth, ft.	Description
I	0-2	Fill: silty fine sand
II	2-10	Soft to very stiff sandy clay and clayey sand
III	10-20	Medium dense to very dense fine sand
IV	20-80	Very stiff to hard clay and silty clay, with sand and silt layers

Figure 2-3 also indicates the presence, at the time of the reconnaissance soil borings in early 1983, of shallow water table conditions at depths of one to five feet beneath the surface throughout the site. The shallow sand strata (strata III in Figure 2-3) appears to be consistently present throughout the site and has a regional extent and significance off-site as

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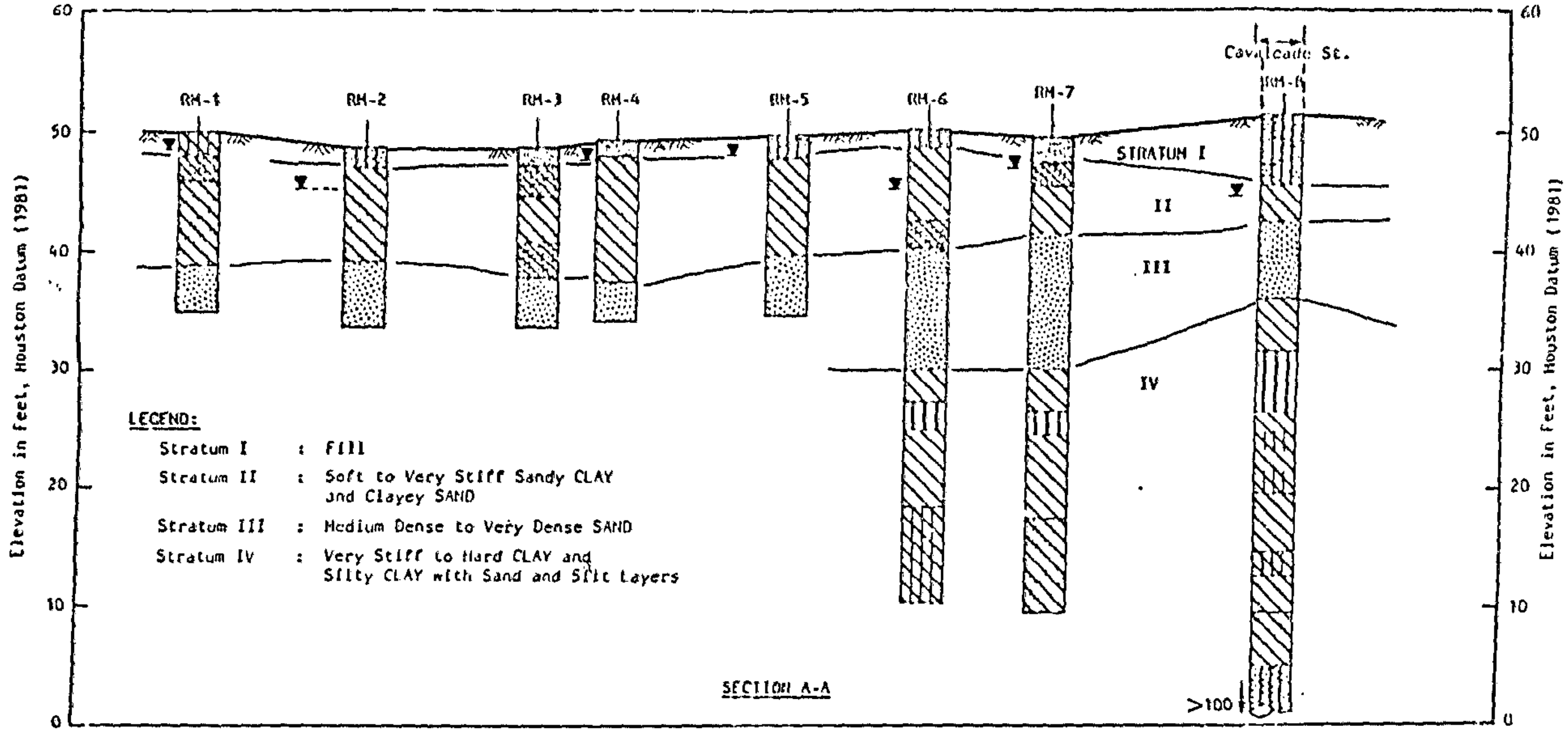


Notes:

1. Data concerning subsurface conditions have been obtained at boring locations only. Actual conditions at locations between borings may differ from the generalized profile shown here.

0 500 1000 Feet

Horizontal Scale

Note:
Information presented here was obtained from McClelland Engineers Report No. 0181-0546-2 dated September 30, 1982.

FIGURE 2-3

SOIL BORINGS & GENERALIZED SOIL PROFILE

well, as indicated by Figure 2-4. Typical shallow sand layers common to the Texas Gulf Coast area usually contain various amounts of silt. The relative permeability of the sand strata will depend largely on the silt content, which varies significantly from place to place. Permeabilities will need to be determined on a site-by-site basis.

Geology

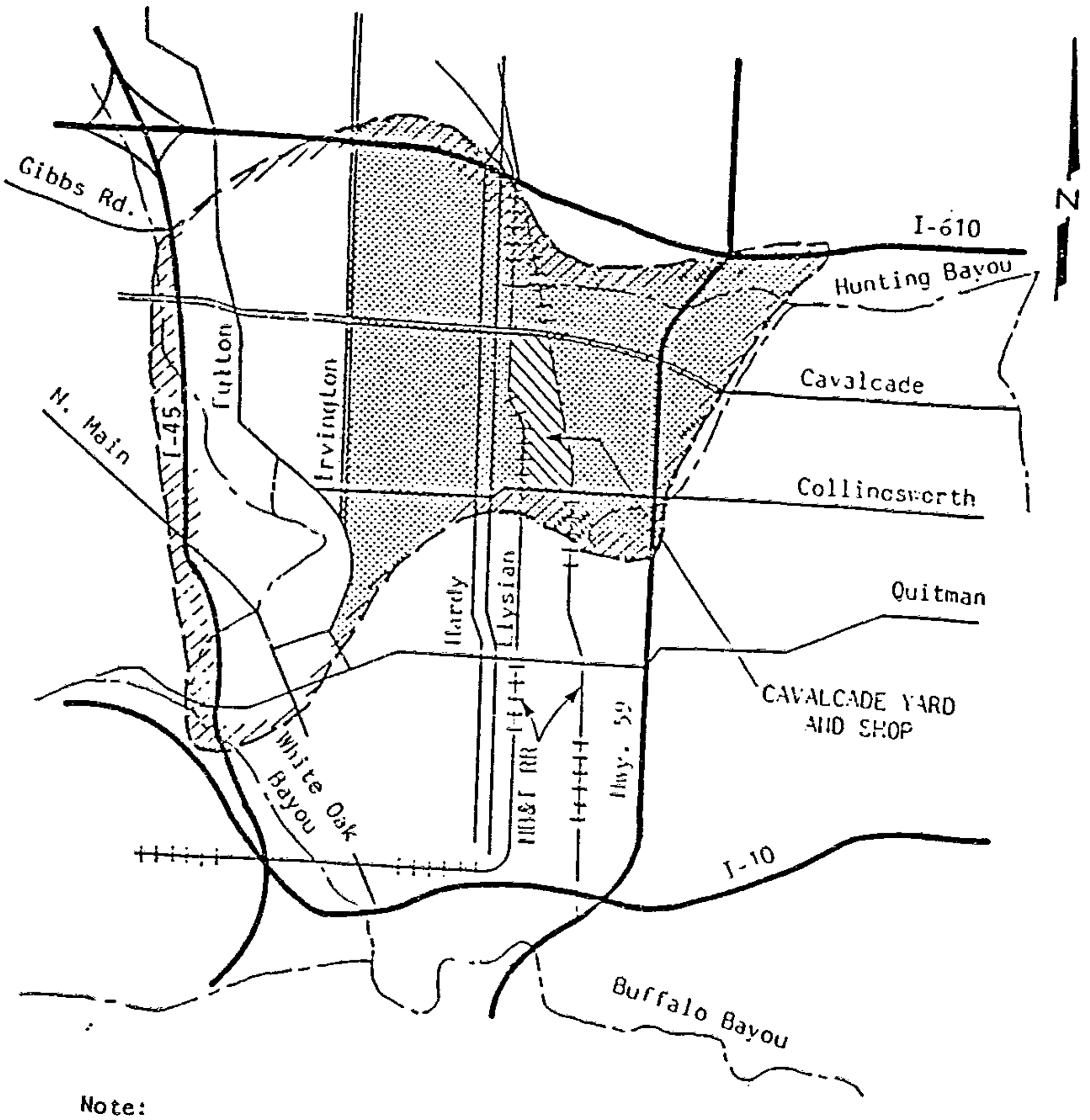
The geologic strata underlying the South Cavalcade Street Site consist principally of interbedded sands, silts, and clays of the Beaumont Formation, deposited in fluvial (river) and deltaic environments of the Pleistocene Epoch. Clay and silt materials predominate in the upper 200 to 300 feet of the Beaumont Formation, with thin discontinuous layers of sand seemingly occurring with random distribution. Thicker, more continuous sand deposits occur in deeper parts of the Beaumont Formation. The Lissie Formation, underlying the Beaumont, also shows extensive sand deposits in the upper strata of the formation.

Hydrology

Both the Lissie Formation and the lower Beaumont Formation are common sources of groundwater supplies in the Houston area, although yields are small and considered inadequate for major exploitation. The deeper sands of the Chicote and Evangeline Aquifers, at depths of over 1,000 feet, are the local sources for major groundwater supplies.

The Beaumont Formation dips generally to the southeast. The regional dip of the strata and the presence of the interbedding sands and clays influence the regional hydrogeology of the entire area. Published geologic literature indicate that the principal areas of recharge for the Chicote and Evangeline Aquifers occur several miles north of the site area.

The predominately clay and silty soils in the upper strata of the Beaumont Formation, in conjunction with the southeastward dip of the formation, serve as a confining layer for the underlying Chicote Aquifer, producing artesian groundwater conditions in the aquifer. Discontinuous sand layers



Note:

Shaded area indicates known areal extent of shallow sand layer, as determined through exploratory borings. Dashed line represents interpolated shallow sand layer area.

Note:
Information presented here was obtained from McClelland Engineers Report No. 0181-0546-2 dated September 30, 1982.

FIGURE 2-4
SHALLOW SAND STRATA MAP

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in the overlying Beaumont are considered too limited for effective recharge to the deeper aquifers.

Drainage

Surface drainage from the site consists of a system of poorly defined surface ditches, with storm water inlets and catch basins to convey run-off into the storm sewer system from the more developed areas on the south and north ends of the site. The undeveloped central part of the site is poorly drained, with surface ditches draining to run-off ditches along the east and west property borders in the railroad rights-of-way.

The southern two-thirds of the site drains generally to the south and east into a southern extension of Hunting Bayou, while the northern third drains to the east directly into Hunting Bayou. Hunting Bayou is a tributary to the Houston Ship Channel several miles downstream of the site.

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Groundwater

A survey of existing water wells in the vicinity of the South Cavalcade Site was conducted for the earlier McClelland Engineers study (report No. 0181-0546-2, dated September 30, 1982). Figure 2-5 depicts the location of existing wells in relation to the site. Three common strata used for groundwater supplies in the site area were identified. The more shallow of the local aquifers is located at elevations of about 170 to 220 feet below ground surface. This aquifer does not have a high yield and is restricted primarily to domestic uses. The second aquifer is found approximately at depths of 400 to 600 feet. This aquifer is developed locally for mainly industrial purposes. A third aquifer is located typically below 1,000 feet and is used primarily as a municipal supply for the City of Houston.

Faulting

The Pecore Fault is the only known active fault in the vicinity of the South Cavalcade Street Site. The fault trends approximately east-west and intersects the surface just north of Cavalcade Street in the immediate

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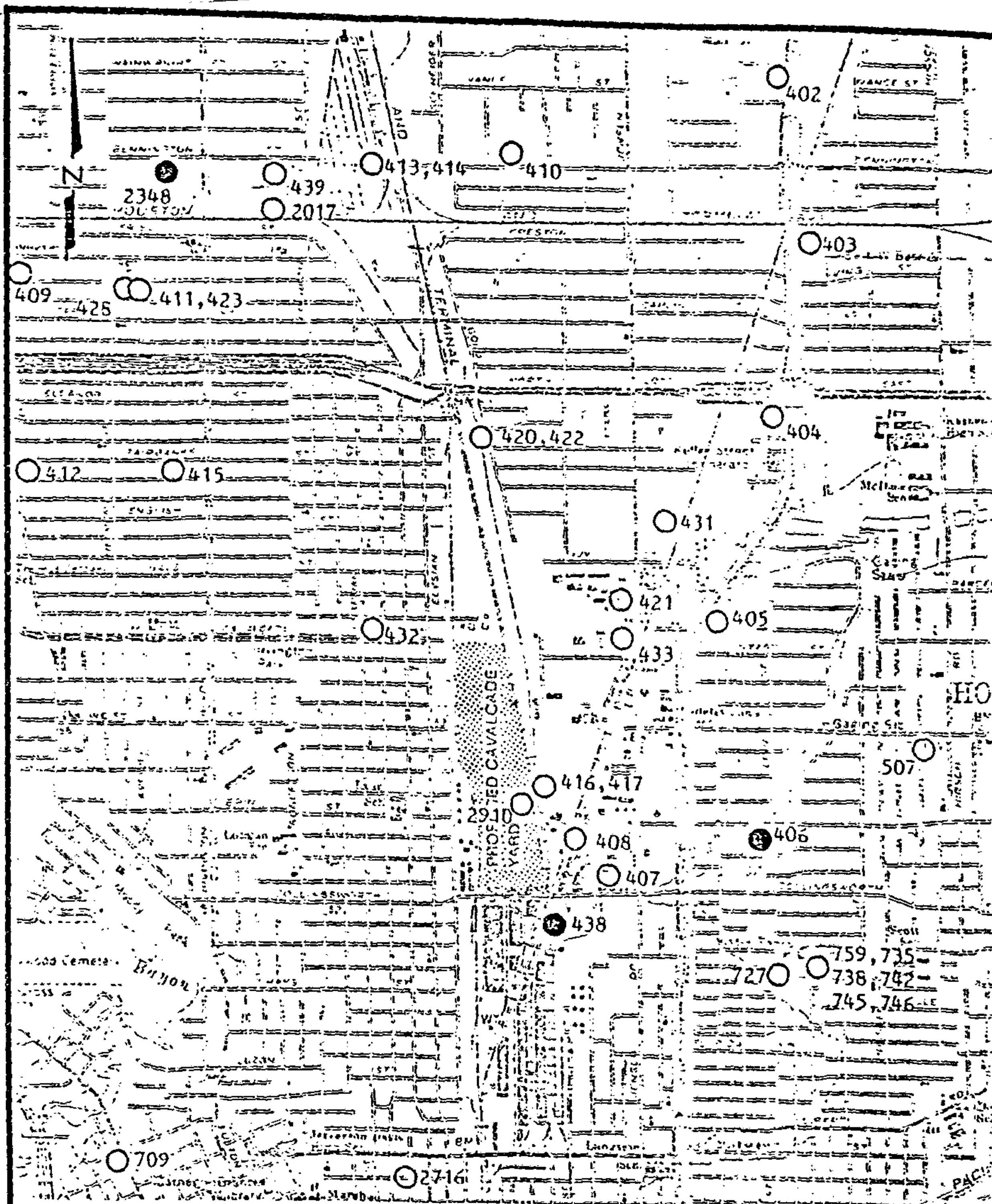

LEGEND:

● Sampled Water Well

○ Existing Water Well

0 2000 4000 Feet

Note:
Information presented here was obtained from McClelland Engineers Report No. 0181-0546-2 dated September 30, 1982.

FIGURE 2-5

WATER WELL LOCATION MAP

CAMP DRESSER & McKEE INC.

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vicinity of the site. The approximate mapped location of the Pecore Fault in the site vicinity is shown on Figure 2-6. The predicted annual differential movements across the fault are about 0.4 inches vertical and 0.1 inch horizontal. Many faults in the Houston area tend to act as partial hydrogeologic barriers to groundwater movements. Isolated portions of a groundwater aquifer may thus have different hydrogeologic characteristics due to local faulting. The extensive withdrawal of groundwater and petroleum supplies in the greater Houston area, resulting in active land subsidence, has caused accelerated fault movements during recent years.

2.2.2 SITE DEVELOPMENT

Present site development conditions consist of support facilities for trucking companies operating at both the north (Cavalcade Street access) and south (Collingsworth Street access) ends of the site. As can be seen on Figure 2-2, a large truck terminal/warehouse facility with associated paved parking and drive areas dominates the southwest part of the site. This facility is owned by Meridan Transport Company (Merchants Fast Motor Lines). The Palletized Trucking, Inc. (Rex King, owner) occupies the southeast part of the site. Development is less extensive and much of the area is used for palletized storage. The middle part of the site (18.2 acres owned by the Meridian Transport Co.) is currently undeveloped land, with no structures or improvements other than minor surface drainage ditches. The northern third of the site is owned by the Baptist Foundation of Texas and currently leased to the Transcon Trucking Lines. Figure 2-2 depicts the location of a truck terminal/warehouse structure in the northwest part of the property, with associated parking and drive areas. A smaller area and structure to the southeast of the Transcon terminal is subleased by Transcon to the AJF Leasing Company.

Water, wastewater, electric, phone, and stormwater facilities serve both the southern and northern developed portion of the site. No utilities are known to exist in the middle undeveloped portion. There are no known waste facilities on the site, but areas of detected contamination are shown on Figure 2-2 as areas 1 through 4.

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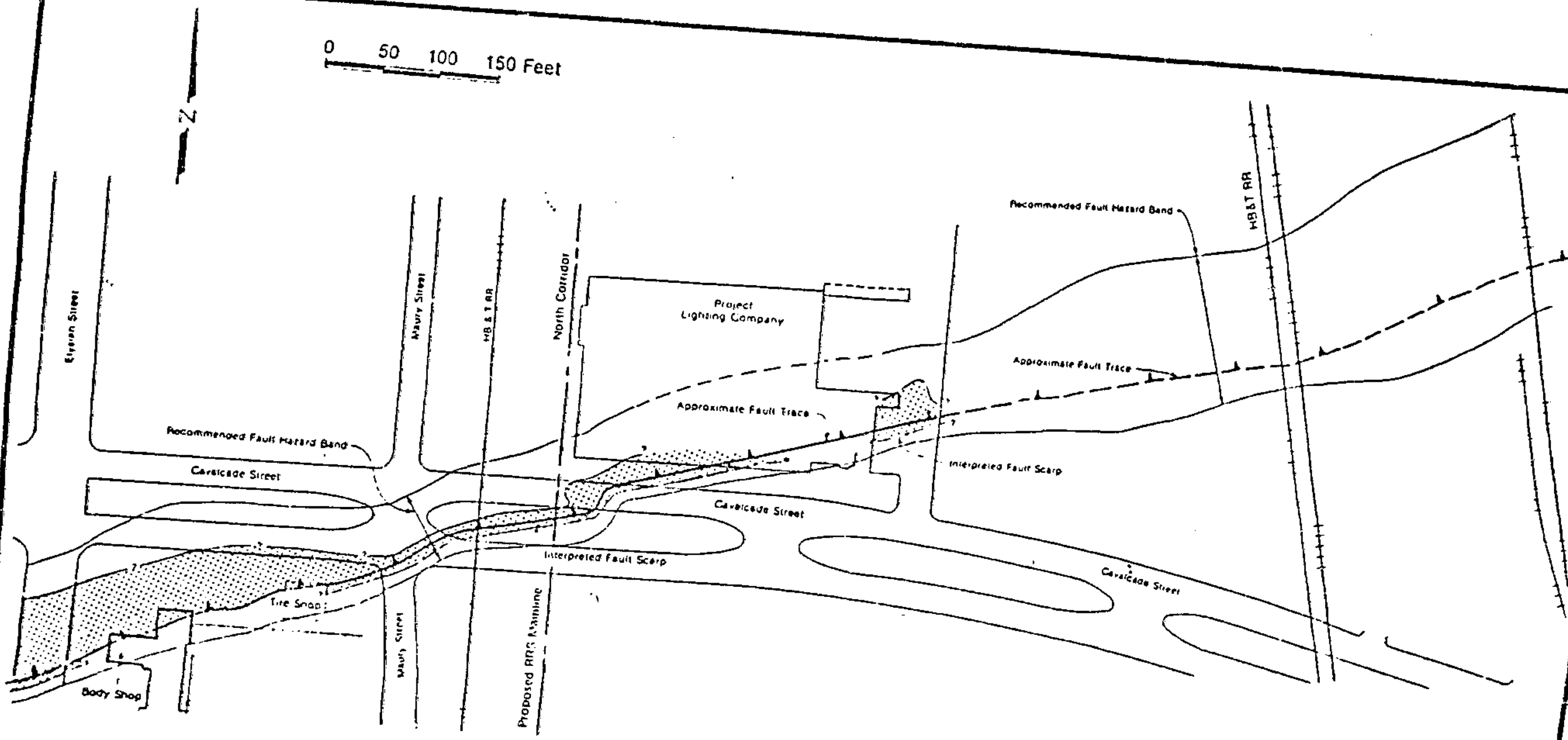


Note.
Information presented here was obtained from McClelland Engineers Report No. 0181-0546-2 dated September 30, 1982

FIGURE 2-6
PECORE FAULT LOCATION

2.2.3 SITE CONTAMINANTS

A preliminary description of contaminants found at the South Cavalcade Street Site by previous investigations provides a basis for remedial investigations. Any actual or potential health or environmental hazards already identified will be described as to types, physical characteristics and quantities, if known. The most probable pathways of exposure and escape of hazardous materials will also be described.

Recent 1982-83 investigations of the South Cavalcade Street Site for the Houston Metropolitan Transit Authority (MTA) revealed areas of localized soil and shallow groundwater contamination. McClelland Engineers, Inc. (MEI) performed a reconnaissance geotechnical survey in 1982 for MTA in relation to then pending plans for a Metro Regional Rail System (RRS). The MEI survey included general soil borings and preliminary foundation investigations for the proposed RRS yard and shop facility at the Cavalcade Site. 001244

Creosote odors were detected during the MEI investigations and soil and groundwater samples were collected for analysis. Trace amounts of napthalene and phenanthrene were identified and it was subsequently determined that the site was contaminated from previous wood preserving operations. It was recommended to MTA that additional investigations be conducted to assess the extent of the contamination problem.

In April of 1983, Camp Dresser & McKee, Inc. (CDM) was selected to perform a contaminant survey of the Cavalcade site. A CDM report, in three volumes, entitled "Cavalcade Contaminant Survey", and dated July 11, 1983, provides a comprehensive assessment of their environmental study.

CDM's site investigation program consisted of the following task activities for the South Cavalcade Site:

Task	Prefix	Number Completed
Sediment Sampling	SD	4
Surface Water Sampling	SW	2
Surface Soil Sampling	SL	4
Soil Borings	SL	10
Subsurface Soil Samples	SL	13
Shallow Observation Wells	OW	9
Deep Observation Well	OW	1
Production Well Sampling	PW	3

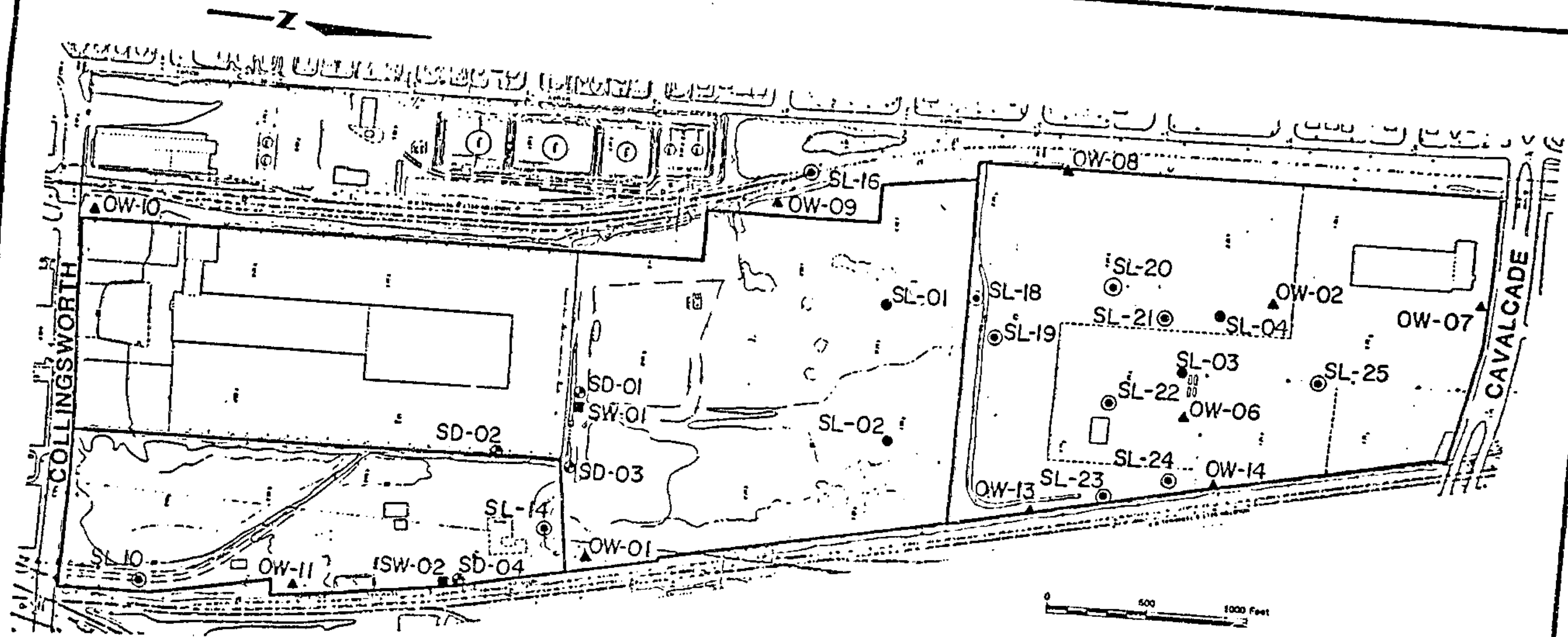
Results of the CDM contaminant survey are summarized in the following paragraphs.

Soil Investigations

Soil borings at sites related to the locations of earlier wood treatment and coal tar distillation facilities during the 1911-1962 period were made to investigate subsurface contamination and migration of contaminants in the near-surface (to 40-foot depths) soil profile. All borings were confined to on-site locations. Figure 2-7 exhibits the locations of the soil boring sites.

Soil sampling depths and intervals were selected to best represent the probable pattern of contaminant concentration and movement. Sampling intervals were continuous from ground surface to 10 feet below ground surface for the deeper, 40 foot borings. Samples were taken for analysis at 5-foot intervals from 10 to 40 feet. The shallow depth borings (10 feet) were at locations more remote from suspected areas of contamination and samples were taken at 2.6 and 8-foot depths below ground surface at these borings.

In all cases, the sampling equipment used was rotary drilling rigs with 3-inch thin wall Shelby tubes, 2-foot long, attached to the bottom of the drill stem. Samples were taken by pressing the tube into undisturbed material at selected depths. The soil samples analysis disclosed contamination with both organic and inorganic compounds in the vicinity of



Note:
Information presented here was obtained from McClelland Engineers Report No. 0181-0546-2 dated September 30, 1982.

LEGEND

- Deep Soil Sample
- Shallow Soil Sample
- Sediment Sample
- Surface Water Sample
- Observation Well

NOTE: SAMPLE LOCATIONS ARE APPROXIMATE.

FIGURE 2-7
SAMPLING LOCATION MAP

suspected disposal areas, particularly near the soil surface. Concentrations of contaminants consistently decreased at greater depths in the soil profile.

CDM's soil boring program also provided visual and olfactory evidence of contamination in subsurface soil samples. All observations of soil contaminants were limited to areas of previously known or suspected waste disposal, with the exception of two off-site borings designated as CAV-SL-16 and CAV-SL-10 on Figure 2-7. These observations (SL-10 and 16) are probably not related to the previous users of the South Cavalcade Site, but to other commercial or industrial sources in the area.

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Sediment Sampling (SD)

Bottom sediment samples were collected from surface drainage areas at the southern end of the site. Locations of sediment sample collections (SD prefix) are shown on Figure 2-7. Detailed analytical results of the sediment sampling for toxic compounds are presented in Section 6.3, Vol. I of the CDM report. The only findings of significance were the presence of low-level refractory organic compounds, particularly the polynuclear aromatic hydrocarbons (PAH), as consistent with the site's history of wood preserving operations. Toxic metal contamination, although posing no significant environmental hazard, may prove to be a problem with respect to ultimate disposal. Table 2-1 displays the results of laboratory sampling analysis for SD-01 through 05.

Surface Water Sampling (SW)

Two surface water samples were collected in conjunction with sediment sample sites SD-01 and SD-04. Surface water sample sites are designated SW-01 and SW-02 on Figure 2-7. No contamination of significance in local runoff water was detected at site SW-01 and only low-level contamination of PAH compounds was observed at the off-site SW-02 sample collected from runoff waters in the railroad drainage ditch. Only cadmium (Cd) and Zinc (Zn) in concentrations below primary and secondary drinking water standards were detected as inorganic or toxic metal contaminants.

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TABLE 2-1

SEDIMENT SAMPLING ANALYTICAL RESULTS

Volatile Organics (all values PPB, ug/kg wet weight)

Contaminant	SD-01	SD-02	SD-03	SD-04	SD-05
Methylene Chloride	100	48	83	110	39

Refractory Organics (all values PPB, ug/kg, wet weight)

Contaminant	SD-01	SD-02	SD-03	SD-04	SD-05
Anthracene	240.	4700.	1600.	2100.	ND
Benzo(a)anthracene	550.	440.	620.	18000.	ND
Benzo(a)pyrene	500.	250.	600.	5400.	ND
3,4-Benzofluoranthene	1100.	890.	1300.	4800.	ND
Benzo(g,h,i)perylene	430.	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	210.	ND	ND	ND	ND
Chrysene	550.	530.	680.	14000.	ND
Floranthene	1100.	750.	1200.	25000.	320.
Indeno(1,2,3,-c,d)pyrene	320.	ND	600.	ND	ND
Phenanthrene	650.	ND	860.	14000.	ND
Pyrene	850.	690.	1100.	22000.	260.
Fluorene	ND	360.	ND	520.	ND
Aceraphthene	ND	ND	ND	580.	ND

Toxic Metals and Inorganics (all values PPM, mg/Kg, wet weight)

Contaminant	SD-01	SD-02	SD-03	SD-04	SD-05
Arsenic (As)	2.0	2.4	1.5	2.2	1.5
Beryllium (Be)	0.2	0.6	0.3	0.5	0.2
Cadmium (Cd)	0.8	0.6	1.0	1.4	ND
Chromium (Cr)	10.0	13.0	12.0	9.7	6.8
Copper (Cu)	13.0	60.0	21.0	82.0	21.0
Lead (Pb)	61.0	88.0	69.0	185.0	20.0
Mercury (Hg)	0.025	0.043	0.032	0.006	0.006
Nickel (Ni)	4.5	4.9	5.4	2.7	2.7
Silver (Ag)	0.40	0.06	ND	ND	ND
Thallium (Th)	ND	0.06	0.97	ND	ND
Zinc (Zn)	160.0	150.0	150.0	30.0	30.0

Surface Soil Sampling (SL)

Four surface soil sampling sites, designated SL-01 thru SL-04 on Figure 2-7 were inspected for contamination. All samples were collected at locations suspected of prior use for disposal of creosote or other wood preserving products. Low-levels of volatile organics were detected at all four sites, with ethylbenzene at SL-04 of minor significance. The previously identified disposal areas, represented by SL-03 and SL-04 are highly contaminated with both PAH and toxic metals at the surface. Analytical results from all four sites indicate that use of an onsite treatment facility is questionable due to high toxic metal assays. Table 2-2 gives the results of analysis for volatile organics, refractory organics, and toxic metals/inorganics at the surface soil sampling sites.

Subsurface Soil Sampling (SL)

Multiple sampling depths at each of 13 locations were sampled to determine the depth of contamination and the structure of the underlying soil profile. Sampling locations selected were either at areas suspected of containing contamination or potential areas of future excavation for the RRS. Subsurface soil sampling sites are designated with the prefix SL on Figure 2-7. Details of the subsurface soil sampling program are found in Section 6.6 of the CDM report.

The previously identified contaminant areas (SL-03 and SL-04) are highly contaminated with both organic and inorganic (toxic metals) compounds at the surface and near-surface (to 5-foot depths), but the level of contamination for most compounds decreases rapidly with depth. At locality SL-03, the contamination from polynuclear-aromatic hydrocarbons decreases by a factor of 100 at the 10-foot depth, with similar declines in inorganic contaminants except for beryllium (Be), nickel (Ni) and silver (Ag). Locality SL-04 demonstrates a similar attenuation of contamination with increasing soil depth, but required greater soil depths (15-foot depth for PAH's and 20-foot depth for most toxic metals) for similar levels of decline. An exception is a continuing high concentration of lead (Pb) at the 20-foot depth for SL-04. Table 2-3 gives the results of analysis for

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TABLE 2-2

SURFACE SOIL SAMPLING ANALYTICAL RESULTS

Volatile Organics (all values PPB, ug/kg wet weight)

Contaminant	SL-01	SL-02	SL-03	SL-04
Methylene Chloride	59	39	59	ND
Ethylbenzene	ND	ND	ND	160
Toluene	ND	ND	ND	23

Refractory Organics (all values PPB, ug/kg, wet weight)

Contaminant	SL-04	SL-02	SL-03	SL-01
Acenaphthene	100,000	ND	780.	ND
Acenaphthylene	3,000	ND	2400.	ND
Anthracene	240,000	ND	12000.	ND
Benzo(a)anthracene	17,000	ND	32000.	200.
Benzo(a)pyrene	4,600	ND	21000.	ND
3,4-benzofluorathene	10,000	ND	46000.	260.
Benzo(g,h,i)perylene	ND	ND	7200.	ND
Benzo(k)fluoranthene	10,000	ND	46000.	260.
Chrysene	11,000	ND	42000.	200.
Fluoranthene	260,000	ND	120000.	ND
Fluorene	80,000	ND	980.	ND
Indeno(1,2,3-c,d)pyrene	ND	ND	7200.	ND
Naphthalene	340,000	ND	1000.	ND
Phenanthrene	240,000	ND	2000.	ND
Pyrene	170,000	ND	110000.	10.
Di-n-octyl phthalate	ND	11	ND	ND

Toxic Metals and Inorganics (all values PPM, mg/kg, wet weight)

Contaminant	SL-04	SL-02	SL-03	SL-01
Arsenic (As)	0.35	2.5	82.0	1.8
Beryllium (Be)	0.29	ND	0.20	0.26
Cadmium (Cd)	0.88	ND	0.10	ND
Chromium (Cr)	12.0	7.6	79.0	14.0
Copper (Cu)	4.4	32.0	21.0	ND
Lead (Pb)	8.4	31.0	54.0	3.4
Mercury (Hg)	0.005	0.009	0.040	0.020
Nickel (Ni)	8.6	33.0	2.7	2.3
Silver (Ag)	0.7	ND	0.20	ND
Thallium (Tl)	ND	ND	0.10	ND
Zinc (Zn)	14.0	40.0	290.0	150.0

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TABLE 2-3

SUBSURFACE SOIL SAMPLING ANALYTICAL RESULTS

SL-03 (All organic values PPB, ug/kg, all inorganic values PPM, mg/kg wet weight basis)

Volatile Organic Contaminants	01 (2)	02 (5)	03 (10)
Methylene chloride	59	40	33
Refractory Organic Contaminants			
Acenaphthene	780.	ND	ND
Acenaphthylene	2400.	280.	ND
Anthracene	12000.	1000.	ND
Benzo(a)anthracene	32000.	5600.	ND
Benzo(a)pyrene	21000.	2000.	ND
3,4-Benzofluoranthene	46000.	6800.	ND
Benzo(g,h,i)perylene	7200.	1600.	ND
Benzo(k)fluoranthene	46000.	6800.	ND
Chrysene	42000.	4500.	ND
Flucranthene	120000.	24000.	ND
Fluorene	580.	ND	ND
Indeno(1,2,3-c,d)pyrene	7200.	1800.	ND
Naphthalene	1000.	ND	ND
Phenanthrene	20000.	5800.	ND
Pyrene	110000.	20000.	ND

SL-03 Toxic Metal Contaminants	01 (2)	02 (5)	03 (10)
Arsenic (Ar)	82.0	1.5	0.33
Beryllium (Be)	0.20	0.20	0.20
Cadmium (Cd)	0.10	ND	ND
Chromium (Cr)	79.0	14.0	3.4
Copper (Cu)	21.0	1.9	1.3
Lead (Pb)	54.0	7.2	7.2
Mercury (Hg)	0.040	0.620	0.009
Nickel (Ni)	2.7	3.0	2.1
Silver (Ag)	0.20	ND	0.88
Thallium (Tl)	0.10	ND	ND
Zinc (Zn)	290.0	23.0	3.6

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TABLE 2-3 (continued)

SL-04 (all organic values PPB, ug/kg, all toxic metal values PPM mg/kg, wet weight basis)

Volatile Organic

Contaminants	01 (2)	02 (5)	03 (10)	04 (15)
Ethylbenzene	160	98	10	ND
Methylene chloride	ND	52	73	ND

Refractory Organic Contaminants

Acenaphthene	100000.	360000.	80000.	540.
Acehaphthylene	3000.	ND	3200.	ND
Anthracene	240000.	520000.	48000.	580.
Benzo(a)anthracene	17000.	27000.	28000.	320.
Benzo(a)pyrene	4600.	7600.	32000.	460.
3,4-Benzofluoranthene	10000.	16000.	7200.	340.
Benzo(g,h,i)Perylene	ND	ND	5000.	ND
Benzo(k)fluoranthene	10000.	16000.	7200.	340.
Chrysene	11000.	20000.	3600C.	320.
Dibenzo(a,h)anthracene	ND	ND	5000.	ND
Fluoranthene	260000.	440000.	120000.	2000.
Fluorene	80000.	110000.	64000.	340.
Indeno(1,2,3-c,d)pyrene	ND	ND	ND	ND
Naphthalene	340000.	640000.	200000.	ND
Phenanthrene	240000.	1100000.	180000.	4400.
Pyrene	170000.	280000.	88000.	1400.
2,4-Dimethylphenol	ND	ND	ND	ND
SL-04				

Toxic Metal

Contaminants	01 (2)	02 (5)	03 (10)	04 (20)
Arsenic	1.8	2.0	1.2	0.29
Beryllium	0.26	0.28	0.6	0.31
Cadmium	ND	ND	0.5	ND
Chromium	14.0	4.1	8.1	3.7
Copper	ND	0.56	7.7	1.2
Lead	3.4	0.37	9.1	6.4
Mercury	0.020	0.005	0.004	0.005
Nickel	2.3	3.70	15.0	4.50
Silver	ND	ND	1.2	ND
Zinc	15.0	23.0	24.0	5.8

organic and inorganic contaminants at respective subsurface soil sampling localities.

Shallow Observation Wells/Groundwater Sampling (OW)

Nine shallow groundwater observation wells were located on the South Cavalcade Street Site to determine the extent of groundwater contamination in the upper (shallowest) aquifer beneath the site and to determine the direction of flow of the groundwater system. Selected wells located near the suspected contamination sources (OW-01 and 02) were sampled for organic contamination. During the upper (shallow) aquifer groundwater sampling program, the organic contamination detected was consistent with previously detected surficial contaminants, except for concentrations of volatile organics (benzene, ethylbenzene and toluene) observed in groundwater samples from OW-02. These aromatic hydrocarbons are more consistent with recent hydrocarbon (petroleum products) contamination. OW-01 showed no detectable volatile organics and significantly fewer and smaller concentrations of refractory organics than found in the groundwater in the OW-02 well. Table 2-4 illustrates the results of chemical analyses of shallow groundwater samples.

The levels of toxic metal contamination found in the upper aquifer groundwater are within EPA primary and secondary drinking water standards and are believed to pose no significant threat to public health or the environment. It is encouraging to note that the high levels of toxic metal contamination found in surface soil samples at these sites are not reflected in associated shallow groundwater samples. This indicates that the toxic metals are not in mobile forms, migrating downward through the soil.

The cyanide concentrations, observed in both wells OW-01 and OW-02 are inconsistent with any known previous industrial source at this site. The presence of cyanide in the shallow groundwater may indicate an off-site source of cyanide compounds in the area.

TABLE 2-4

SHALLOW GROUNDWATER SAMPLING ANALYTICAL RESULTS

Volatile Organics (all values reported as PPB, ug/l)

Contaminants	OW-01	OW-02
Benzene	ND	21
Ethylbenzene	ND	58
Toluene	ND	110

Refractory Organics (all values reported as PPB, ug/l)

Contaminants	OW-01	OW-02
2,4-Dimethylphenol	ND	680
Pentachlorophenol	ND	66
Phenol	ND	59
Acenaphthene	49	380
Acenaphthylene	17	30
Benzo(a)pyrene	NA	29
Bis(2-ethylhexyl) phthalate	ND	17
Butyl benzyl phthalate	ND	17
Di-n-butyl phthalate	ND	34
Fluoranthene	23	34
Fluorene	73	300
Naphthalene	670	17000
Phenanthrene	160	240
Pyrene	17	27

Toxic Metals and Inorganics (all values reported as PPM, mg/l)

Contaminant	OW-01	OW-02
Arsenic (As)	ND	0.13
Copper (Cu)	0.06	ND
Zinc (Zn)	0.12	0.20
Total Cyanide (Cn)	0.70	0.10

Deep Groundwater Sampling

A deep (200 foot) groundwater monitoring well, designated as OW-06 on Figure 2-7, was installed and sampled to determine the extent of possible groundwater contamination in a lower aquifer, principally used in the area as a source of domestic water supply. A representative groundwater sample was collected following well stabilization. Two soil samples were collected from soil immediately above and below the well screen depth. The groundwater sample and the two soil samples were analyzed for appropriate organic and inorganic contaminants.

With the exception of trace concentrations of toluene in the groundwater sample, the deep (200 foot) aquifer and the associated soil samples were uncontaminated with any other organic compounds. Inorganic contaminants are present in detectable concentrations in the deep soil samples, but only antimony (Sb), arsenic (As) and selenium (Se) were observed in the ground-water sample. The inorganic compounds (particularly arsenic and selenium) are at low concentrations (As-0.05, Se-0.26) within primary drinking water standards and present no public health or environmental threat. The presence of arsenic at 12.0 mg/kg in the soil samples may indicate a rather high natural background of this toxic material in the local clay substrata. Table 2-5 gives the results of analysis of the deep groundwater sample.

Production Well Samples

Selected production wells located within close proximity to the site were sampled to determine the extent of any external migration of contaminants. Production well depths ranged from 300 to 500 feet below ground surface. Sampled production wells, labeled PW-01, 02, and 03 on Figure 2-7, proved to be uncontaminated with any detectable organic compounds. Inorganic concentrations in excess of primary drinking water standards were observed in PW-01 for lead (0.36 ppm), in PW-02 for both cadmium (0.04 ppm) and lead (0.35 ppm) and in PW-03 for lead (0.30 ppm).

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TABLE 2-5

DEEP GROUNDWATER SAMPLING ANALYTICAL RESULTS

Volatile Organics (all values reported as PPB, ug/l)

Contaminant	OW-06 (06)	SL-11 (Soil) (11)	SL-19 (Soil) (19)
Toluene	49	ND	ND

Refractory Organics

No Compounds detected.

Toxic Metals and Inorganics (all values reported as PPM mg/l or mg/kg wet weight)

Contaminant	OW-06	SL-11 (Soil)	SL-19 (Soil)
Antimony (Sb)	0.1	ND	ND
Arsenic (As)	0.05	12.0	12.0
Beryllium (Be)	ND	0.30	0.31
Cadmium (Cd)	ND	0.30	0.31
Chromium (Cr)	ND	17.0	2.4
Copper (Cu)	ND	06	4.0
Lead (Pb)	ND	5.7	7.5
Mercury (Hg)	ND	0.003	ND
Nickel (Ni)	ND	1.5	4.6
Selenium (Se)	0.260	ND	ND
Silver (Ag)	ND	ND	ND
Thallium (Tl)	ND	2.1	1.9
Zinc (Zn)	ND	3.1	7.3

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2.2.4 POTENTIAL IMPACTS, EXPOSURE OR CONTAMINANT RELEASE

The available site characterization data summarized above is useful in predicting potential onsite and off-site impacts such as possible contaminant exposure or release to other environments. The two principal hazard areas of potential health or environmental significance, identified from preliminary assessment of the data, are the surface and near surface contamination of the soil materials in the immediate vicinity of previously identified disposal areas, and the associated shallow groundwater contamination observed in the same general areas. Preliminary findings indicate that surface water impacts are apparently not a significant health or environmental concern. Deep percolation and contamination of local groundwater aquifers used for domestic, industrial or municipal water supplies also do not appear to constitute a threat to public health, welfare, or the environment.

Surface and Near-Surface Contamination

Residual contaminants from earlier wood preserving and coal tar distillation activities at this site appear to be restricted mainly to surface and near-surface (10-foot depths, or less) contamination with both organic (polynuclear aromatic hydrocarbons) and inorganic (toxic metal) compounds in the immediate vicinity of previous disposal sites.

The potential impacts of the surface and near-surface soil contamination in these areas are as sources of continued shallow groundwater contamination, and as sources of contaminant release to local environments from future development or use of the site. The soil contaminants do not appear to be an imminent threat to health or the environment due to volatilization, direct contact, or surface runoff exposures under present conditions.

Shallow Groundwater Contamination

The groundwater sampling program conducted by CDM indicated that the shallow water table conditions at the site and the shallow sand strata

(strata III on Figure 2-3) are locally contaminated with both PAH and toxic metal compounds. The areal extent of present groundwater contamination is not yet known, however, due to the limited groundwater sampling carried out during the CDM contaminant survey. It is possible, however, that the shallow groundwater contamination is extensive, even extending off-site. More comprehensive sampling of local groundwater conditions will be necessary to determine the extent and rate of migration of contaminants in the shallow groundwater in and near the site. There are no known uses of the shallow groundwater, no known surface exposures such as ponds or standing water, and no known present concerns with discharges from the shallow sand strata to local surface drainage. It is also very likely that the shallow groundwater continues to be contaminated by a variety of local urban and industrial sources.

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2.2.5 OFF-SITE CONTAMINATION

At this stage of site investigations, there are no known off-site contamination problems related to surface waters, groundwaters, air or waste transport originating from this site.

2.2.6 AREA LAND USE

The areas surrounding the site are mixed residential, commercial, and industrial. Old, established, low-income neighborhood areas, transportation facilities (railroads and freeways), and a variety of commercial/industrial operations dominate the general area. A variety of institutional facilities (schools, churches, parks) also exist in the general area of the site.

2.2.7 SURFACE AND GROUNDWATER USE

See Section 2.2.1 and Figure 2-5.

2.2.8 ENVIRONMENTAL IMPACTS/PUBLIC HEALTH IMPLICATIONS

See Section 2.2.4.

3.0 POTENTIAL APPROACHES TO SITE REMEDIATION

Based on current understanding of the geology and hydrogeology at the South Cavalcade Street Site, the history of use at the site, and the extent and potential pathways for migration of contaminants from the site, the following remedial alternatives are offered. Criteria for evaluating candidate alternatives are also offered, and the data needed to screen and evaluate the candidate remedial alternatives are identified. Finally, an overall technical approach is described for their evaluation and comparison. The list of candidate remedial alternatives presented herein is not intended to be exhaustive or all encompassing. Additional options may be identified during the course of the Remedial Investigation for evaluation during the Feasibility Study.

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3.1 IDENTIFICATION OF CANDIDATE REMEDIAL ALTERNATIVES

Remedial Alternative candidates have been preliminarily identified for four areas of concern: rainfall runoff and surface water, shallow groundwater, deeper groundwater, soils and non-soils materials. The list of candidates is based on a current understanding of the site and the nature of the contamination at the site. Candidate alternatives may be considered singly or in combinations. These candidate options are consistent with the criteria presented below:

- Includes off-site treatment and disposal;
- Complies with all applicable and/or relevant federal public health or environmental standards;
- Exceeds the requirements of all applicable and/or relevant federal public health and environmental standards;
- Does not comply with applicable or relevant federal public health standards, but will reduce the likelihood of present or future threats of contamination from the hazardous substance on the site or pollutants that might emanate from it; and
- Includes a no-action alternative.

3.1.1 RAINFALL RUNOFF AND SURFACE WATER

The following remedial alternatives were identified to address rainfall runoff and surface water ponded on the site after a precipitation event.

A. <u>No Action</u>: Under this alternative no changes would be made to the surface drainage patterns existing on the site. Surface water that accumulates on the site after a precipitation event would be allowed to percolate into the ground or to run off the site into the stormwater drainage system. No attempt would be made to contain or detain the runoff or to test and, if necessary, treat the runoff. Additionally, no attempt would be made to prevent ponding of rainwater or to channel the runoff to specific ponds or runoff channels. The topography at the site would be left exactly as it is today, except for modifications necessary to implement other remedial measures.

B. <u>Discharge to Sanitary Sewer System</u>: Under this alternative, the surface of the site would be regraded where necessary to prevent rainfall from ponding on the non-paved areas or flowing off of the site. All runoff from these areas would be channeled to lined catchment basins for discharge to the sanitary sewer system and subsequent treatment by the municipal wastewater treatment plant. No pretreatment would be performed except for sediment removal in the catchment basins. Sediment accumulating in the catchment basins would be analyzed and:

- Spread on the surface of the site without regard to potential contamination;
- Removed to a secure disposal site established onsite; or
- Removed for off-site disposal at an approved site.

C. <u>Tank Truck Removal</u>: Under this alternative, the surface of the site would be regraded to prevent the rainfall from ponding in non-paved areas or from flowing off the site. All runoff from these unpaved areas would be channeled to lined catchment basins for collection and transportation off-site by tank trucks. Disposal would be at an approved facility.

D. <u>Onsite Treatment/Discharge to the Stormwater System</u>: Under this alternative, the surface of the site would be regraded to prevent rainfall from flowing off the site or ponding on non-paved areas, and all runoff from these areas would be channeled to lined catchment basins for onsite treatment and subsequent discharge to existing stormwater channels. The onsite treatment might include air-stripping, adsorption onto activated carbon, and/or other physical/chemical treatment methods. The level of treatment required would be established by the terms and conditions of a NPDES permit and a permit from the State of Texas.

E. Onsite Treatment/Discharge to the Sanitary Sewer System: Under this alternative, the site would be regraded to prevent rainfall from flowing off the site or from ponding on non-paved areas. All runoff from these areas would be channeled to lined catchment basins for onsite treatment and subsequent discharge to the sanitary sewer system. The onsite treatment might include air-stripping , adsorption onto activated carbon, and/or other physical/chemical treatment methods. The level of treatment would be in accordance with the applicable industrial pretreatment standards of EPA and the State of Texas.

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3.1.2 SHALLOW GROUNDWATER

The following remedial alternatives were identified to address shallow groundwater contaminated by creosote and other wood preserving materials reported to be used at this site. The alternatives were formulated based on the observation that contaminants are migrating off-site through surface and subsurface discharge.

A. No Action: Under this alternative, there would be no attempt to implement a shallow groundwater containment or treatment system. In addition, no further action would be taken to monitor or improve the groundwater quality.

B. Continued Monitoring: Under this alternative, no groundwater recovery program would be implemented, but a long-term monitoring program as presented in Section 4.0 and adjusted by the RI results would be initiated to detect changes in the quality of the shallow groundwater leaving the site. In that wood preserving activities on the site reportedly began more than 60 years ago and ceased approximately 24 years ago, contamination of the shallow groundwater has probably been occurring for a long time. There is no known use of the shallow groundwater in the vicinity of the site. Monitoring would be continued:

- o Permanently;
- o Until analytical results indicated that no further degradation in groundwater quality was occurring;
- o Until analytical results indicated a long-term trend of improving groundwater quality; or
- o Until analytical results indicated that the groundwater was essentially free of contaminants originating from the site or that the level of contaminants met accepted standards.

C. Cap: Under this alternative the entire site, or major portions of it would be capped by relatively impermeable material imported to the site. The purpose of a cap would be to restrict the infiltration of rainfall through contaminated soils on the site and, to direct the runoff off the site. Periodic sampling would be required to monitor effectiveness of this remedial measure. No attempt would be made to cleanup existing contamination of groundwater or restrict the movement of groundwater beneath the site.

D. In Situ Biologic Decomposition: Under this alternative, microbes capable of altering the contaminants in the groundwater to nontoxic or nonhazardous byproducts would be introduced. Nutrients, water, or other substances might be necessary to encourage microbial activity and viability. Periodic monitoring would be performed to ascertain the effectiveness of the treatment. The frequency and location of this monitoring program would be established during the development and implementation of the treatment process.

E. Installation of a Slurry Wall and Cap: Under this altern.tive a slurry wall would be installed around the perimeter of the site to restrict contaminated groundwater from leaving the site and uncontaminated groundwater from entering the site. This alternative would require a cap and the installation of one of the groundwater recovery operations described below. The slurry wall would be installed to a confining layer.

F. Groundwater Recovery/Discharge to Sanitary Sewer System: Under this alternative, a groundwater recovery program would be initiated for the shallow aquifer and the resulting water discharged into the sanitary sewer system for treatment at the municipal wastewater treatment plant. Pretreatment of this water would have to be determined in the remedial investigation. Discharge into the sanitary sewer system would be in accordance with the terms and conditions of applicable industrial waste pretreatment standards of EPA and the State of Texas. Again, monitoring would be necessary to assess the effectiveness of this alternative.

G. Groundwater Recovery/Tank Truck Removal: Under this alternative, a groundwater recovery program would be initiated for the shallow aquifer and the resulting water collected and stored for transportation off-site and disposal. Monitoring would be necessary to assess the effectiveness of this alternative.

H. Groundwater Recovery/Onsite Treatment: Under this alternative, a groundwater recovery program would be initiated for the shallow aquifer and the resulting water treated onsite. Treatment would consist of air-stripping, adsorption onto activated carbon, or other physical/chemical treatment steps as necessary. Discharge would be:

- To the sanitary sewer system;
- To surface water streams or drainage ditches; or
- Returned to the aquifer.

The level of treatment would be in accordance with applicable standards of EPA and the State of Texas. Recovery of raw products may

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be possible and economically advantageous, and should be investigated. Any off-site groundwater treatment program would be considered to be integrated the onsite treatment system unless the volume of water and the cost of transportation necessitated establishment of one or more off-site treatment systems. Treatment would continue until monitoring established that the groundwater was essentially free of contaminants originating from the site or until the level of contamination permitted disposal of the water without pretreatment. Return of the treated water to the shallow aquifer would be such that it would provide a water drive to enhance recovery operations. Monitoring would be required to monitor the cleanup of the shallow aquifer.

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3.1.3 DEEPER GROUNDWATER

The following remedial alternatives were identified to address potential contamination of the deeper groundwater by creosote and other wood preserving materials. Although no contamination has been detected in the deeper groundwater to date, additional wells and samples might reveal that such contamination has occurred. The alternatives were formulated in consideration of the possibility that the contaminants may have migrated off-site.

A. No Action: Under this alternative, there would be no attempt to implement a groundwater treatment or containment program. In addition, no further action would be taken to monitor changes in groundwater quality.

B. Continued Monitoring: Under this alternative, no groundwater recovery program would be implemented, but a long-term monitoring program would be developed and initiated to detect changes in the quality of deeper groundwater. Monitoring would be continued:

- Permanently;
- Until analytical results indicate that there is no further degradation of groundwater quality;

- Until analytical results indicate that the long-term trend is for improvement in the water quality; or
- Until the analytical results indicate that the groundwater is essentially free of contaminants originating from the site or that the level of contaminants in the groundwater is within accepted criteria limits.

C. In Situ Biologic Decomposition: Under this alternative, microbes capable of altering the contamination in the deeper groundwater into nontoxic, nonhazardous byproducts would be introduced. Addition of nutrients, water or other substances might be necessary to encourage and sustain microbial activity. Monitoring would be necessary to assess the effectiveness of the treatment system.

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D. Groundwater Recovery/Discharge to Sanitary Sewer System: Under this alternative, a groundwater recovery program would be implemented for the deeper aquifer and the resulting water discharged into the sanitary sewer system for treatment by the municipal wastewater treatment plant. Pretreatment of this water will be determined based upon sampling and analytical results. Discharge into the sanitary sewer system would be in accordance with applicable industrial waste pretreatment standards of EPA and the State of Texas. Monitoring would be necessary to assess the effectiveness of this alternative.

E. Groundwater Recovery/Tank Truck Removal: Under this alternative, a groundwater recovery program would be implemented for the deeper aquifer and the resulting water collected and stored for transportation off-site and disposal. Monitoring will be necessary to monitor the results of the recovery program.

F. Groundwater Recovery/Onsite Treatment: Under this alternative, a groundwater recovery program would be implemented for the deeper aquifer and the resulting water treated onsite. Treatment would consist of air-stripping, adsorption onto activated carbon, or other physical/chemical treatment methods, as necessary. Discharge would be:

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- To the sanitary sewer system;
- To surface water streams or drainage ditches;
- Reinjected into the deeper aquifer; or
- Injected into the shallow aquifer.

The level of treatment would be in accordance with applicable standards of EPA and the State of Texas. Water produced by any off-site recovery program would be returned to the site for treatment unless the volume of water and the cost of transportation necessitated establishment of one or more off-site treatment centers. Recovery of raw products may be possible and economically advantageous. Treatment would continue until monitoring established that the groundwater contaminated by pollutants from the site was essentially free of those contaminants, or until the level of contamination permitted disposal without onsite pretreatment, or until the level of contaminants in the deeper groundwater was within accepted standards. Reinjection of the treated groundwater into the deeper aquifer or injection into the shallow aquifer would be such that it would provide a water drive to enhance recovery operations, to the extent possible. Long-term monitoring might be necessary to ensure that the deeper groundwater did not become recontaminated.

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3.1.4. CONTAMINATED SOILS

The following alternatives were identified to address contamination of soils on the site as well as those soils transported from the site as part of the recent sand and gravel operations. These alternatives were formulated to provide long-term protection for those who currently live or engage in activities on the site, who might work at the sand and gravel operation in the future, and the local population. Of primary concern are those areas that are identified through the field sampling program as the major areas of soil contamination. Groundwater encountered during treatment or removal of these soils would be dealt with as described previously.

A. No Action: Under tnis alternative, all contaminated soils would be left onsite without treatment.

B. Cap: Under this alternative, the entire site or major portions of it would be capped by relatively impermeable material (clay) imported to the site, or by flexible pavement. The purpose of the cap would be to isolate contaminated soils from those people currently living on the site, from those who might work on the site in the future, and from the local populace. A provision for perpetual maintenance of the cap would be necessary.

C. In situ Chemical Fixation: Under this alternative the contaminated soils would be chemically fixed and/or solidified in place to prevent migration of pollutants off-site or further exposure to on-site workers and the adjacent populace.

D. Incineration: Under this alternative, the contaminated soils would be excavated and destroyed in a high temperature incinerator. This operation could take place either onsite, using an approved portable incinerator, or off-site, at an approved commercial facility. If destroyed onsite, the residue would have to be analyzed for onsite or off-site disposal requirements. Excavated areas would be backfilled with with clean material from the site, or imported from off-site.

E. Removal/Disposal: Under this alternative, the contaminated soils would be excavated and transported to a Class I facility approvec by the Texas Department of Water Resour es. Determination of the material that must be removed would bε oased on:

- Visual contamination; or
- Chemical analyses that indicate an unacceptable level of contamination.

Any excavations resulting from removal of contaminated soils would be filled with clean, uncontaminated material, derived onsite, or with material imported from off-site. Capping and provisions for

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positive drainage of the area of the excavation may be necessary to ensure that contact with remaining, but undetected contaminants is eliminated.

F. Excavation/Disposal in Onsite Vault: Under this alternative, contaminated soils would be excavated and disposed of in a specially constructed (RCRA) vault onsite, either above grade or below grade. If constructed below grade, the material excavated to make the vault could be used to backfill the excavation created by the removal of the contaminated material; testing would be required to ascertain its suitability. If the vault is constructed above grade, material to fill the excavation created by the removal of contaminated material must be imported and, perhaps, capped with compacted clay. Continuous inspection of the vault and long-term monitoring of the groundwater in the vicinity of the vault would be necessary to ensure its integrity. Provisions for permanent maintenance of the vault and the area around the vault would be necessary.

G. Excavation and Onsite Treatment: Under this alternative, the contaminated soils would be excavated and renovated onsite using microbial action to degrade the contaminants. Recovery of any raw product encountered would be encouraged by the addition of acclimated microorganisms, nutrients, moisture, and heat, if necessary. The treated soils materials would be replaced into the excavation or disposed of off-site, as required. Any excavations remaining would be backfilled with clean material derived onsite or with material imported from off-site and capped to reduce infiltration and provide for positive drainage.

3.1.5 NON-SOIL MATERIALS

The following alternatives were identified to address the potential occurrence of contaminated nonsoil materials -- timbers, concrete, steel containers, or others -- that might be encountered during the remedial investigation phase or any subsequent remedial activities. The concern is

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to provide long-term protection for those currently living on the site or who might work on the site in the future and for the local populace. Any groundwater encountered during the removal of these non-soil materials would be treated as previously described. Contaminated soil encountered beneath or adjacent to the contaminated non soil material would also be treated as described above.

A. No Action: Under this alternative, any non-soil materials encountered on the site that are contaminated would remain undisturbed on the site.

B. Incineration: Under this alternative, contaminated non-soil materials encountered on the site would be destroyed in a high temperature incinerator either onsite, using an approved portable incinerator, or off-site at an approved commercial facility. Destruction of non-soil materials by incineration could be carried out in conjunction with incineration of contaminated soils or as a separate remedial action. Any excavation resulting from removal of the non-soil materials would be backfilled, as necessary, with clean material derived onsite or with material imported from off-site. Capping of the excavated area would also be accomplished to reduce infiltration and provide for positive drainage.

C. Removal/Disposal: Under this alternative, the contaminated non-soil materials would be removed from the site and transported to a Class I facility permitted by the Texas Department of Water Resources. Any excavation would be backfilled with clean material derived onsite or with material imported from off-site. Capping of the excavated area would be accomplished to reduce infiltration and provide for positive drainage.

D. Removal and Disposal in an Onsite Vault: Under this alternative, contaminated, non-soil materials would be moved and disposed of in a specially constructed vault (RCRA) onsite. The vault could be constructed above grade or below grade. If constructed below grade, the material excavated to construct the vault could be used

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to fill any excavations left by removal of the non-soil material; testing would be required to ensure suitability of the material. If the vault is constructed above grade, it may be necessary to import clean material to the site to fill the excavation left by the removal of the non-soil material. Continual inspection of the vault will be necessary, as will long-term monitoring of the groundwater beneath the vault. Provisions for permanent maintenance of the vault and the area around the vault will be necessary.

3.2 ESTABLISHING CLEAN-UP CRITERIA

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3.2.1 INTRODUCTION

The remedial actions developed for the South Cavalcade Street site will be subject to federal, state and local environmental and public health regulations and standards which affect design, operation and levels of cleanup posed by each alternative. The remedial alternatives identified in Section 3.1 above provide varying degrees of mitigation of the hazards presented by the South Cavalcade Street Site. The alternatives identified provide a range of options that allow compliance with all applicable public health or environmental standards, exceed the requirements of those standards, or do not comply with the letter of those standards but do significantly reduce the threat of further contamination through the implementation of a permanent solution. Although the use of standards at Superfund sites is still under development by EPA, it is EPA policy to comply with applicable or relevant environmental and public health standards in CERCLA remedial actions except under certain limited circumstances. Accordingly, the applicable standards will be used as a measure for evaluating and comparing each alternative action.

As defined in EPA guidance for CERCLA feasibility studies, applicable standards are those that would be legally applicable if the actions were not taken pursuant to CERCLA Section 104 or Section 106. Relevant standards are those pertinent to the site based on scientific or technological considerations. A list of applicable and relevant standards that apply to the South Cavalcade Street site are listed on Table 3-1.

TABLE 3-1

REQUIREMENTS, ADVISORIES, AND GUIDANCE TO BE CONSIDERED

1. Federal Requirements, Advisories and Procedures

- Recommended Maximum Concentration Limits (RMCLs)
- Health Advisories, EPA, Office of Water
- Federal Water Quality Criteria

  Note: Federal water quality criteria are not legally enforceable. State water quality standards, developed using appropriate aspects of cases, States' water quality standards do not include specific numerical limitations on a large number of priority pollutants. When there are no numerical State standards for a given pollutant, Federal water quality criteria should be considered.

- Public health basis in listing decision under Section 112 of the Clean Air Act
- EPA's groundwater protection strategy
- TSCA health data
- TSCA chemical advisories (two or three issued to date)
- Advisories issued by FWS and NWFS under the Fish and Wildlife Coordination Act
- National Environmental Policy Act
- TSCA Compliance Program Policy
- Resource Conservation and Recovery Act

2. State Requirements

- Texas Department of Water Resources State Ground Water Withdrawal Approvals
- Requirements of TDWR hazardous waste program
- State Implementation Plan and Delegated Programs Under Clean Air Act
- Texas Department of Health Drinking Water Criteria
- All other State requirements, not delegated through EPA authority.

TABLE 3-1 (continued)

3. Local Requirements

- Standards of National Pollutant Discharge Elimination System permit for local publicly-owned wastewater treatment facility.
- Local solid waste management ordinances
- Local zoning laws and regulations
- Other local requirements

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Table 3-2 lists existing EPA ambient environmental concentration standards that may be applicable to public health analysis. These standards include the following:

- Maximum Contaminant Levels (MCLs) promulgated under the Safe Drinking Water Act, for 20 chemicals and also radionuclides in drinking water;

- National Ambient Air Quality Standards (NAAQS) promulgated under the Clean Air Act, for 7 pollutants in ambient air;

- National ambient water quality criteria developed under the Clean Water Act for 95 contaminants in ambient water systems (not drinking water), which are nonenforceable federal criteria but are often the basis of enforceable state water quality standards, classified as applicable requirements for remedial actions; and

- Health advisories (suggested no adverse response levels, or SNARLs) developed under the Safe Drinking Water Act, covering 22 contaminants in drinking water.

The environmental standards and criteria in Table 3-2 were developed under a variety of statutes, and many incorporate economic or scientific factors inappropriate for CERCLA. The standards generally do not consider simultaneous exposure from multiple routes. Standards may also be based on levels, durations, or frequencies of exposure that are different from those at a specific site. As a result of the various technical aspects of standards development, some concentration limits will require adjustment before being applied to the South Cavalcade Street Site. It should also be noted that relevant or applicable ambient concentration limits are not available for all media for many chemicals commonly found at Superfund sites. For these reasons, it will be necessary to consult with EPA to review the exposure assessment and determine the appropriate range of cleanup levels for the constituents encountered at the South Cavalcade Street Site.

Table 3-2

AMBIENT STANDARDS AND CRITERIA FOR SUPERFUND REMEDIAL SITES

	Applicable or Relevant Requirements		Other Criteria, Advisories, and Guidance				
Chemical	Safe Drinking Water Act, MCLs, (mg/L unless otherwise noted)	Clean Air Act, NAAQS (ug/m^3)	Clean Water Act Water Quality Criteria for Human Health Fish and Drinking Water	Clean Water Act, Water Quality Criteria for Human Health Drinking Water Only	Safe Drinking Water Act, Health Advisories (mg/L) 1-day	10-day	Chronic (weeks or months)
Acenaphthene			20 ug/L (organoleptic)[a]	20 ug/L (organoleptic)			
Acrolein			320 ug/L	540 ug/L			
Acrylonitrile			0 (0.58 ug/L)[b]	(0.63 ug/L)[b]			
Aldrin			0 (0.74 ng/L)	(12 ng/L)			
Antimony			146 ug/L	(146 ug/L)			
Arsenic	0.05		0 (22 ng/L)	(25 ng/L)			
Asbestos			0 (300,000 fibers/L)	(300,000 fibers/L)			
Barium	1.0						
Benzene			0 (6.6 ug/L)	(6.7 ug/L)		0.23	0.07
Benzidine			0 (1.2 ng/L)	(1.5 ng/L)			
Beryllium			0 (37 ng/L)	(39 ng/L)			
Cadmium	0.01		0 (10 ug/L)	(12 ug/L)			
Carbofuran					0.1	0.1	0.005
Carbon monoxide		40,000 (1-hour)[c] 10,000 (8-hour)[c]					
Carbon tetrachloride			0 (4.0 ug/L)	(4.2 ug/L)	0.2	0.02	
Chlordane			0 (4.6 ng/L)	(220 ng/L)	0.0625	0.0625	0.0075
Chlorinated benzenes							
Hexachlorobenzene			0 (7.2 ng/L)	(210 ng/L)			
1,2,4,5-Tetrachlorobenzene			0 (38 ug/L)	(180 ug/L)			
Pentachlorobenzene			0 (74 ug/L)	(570 ug/L)			
Trichlorobenzene			Insufficient data	Insufficient data			
Monochlorobenzene			488 ug/L	488 ug/L			
Chlorinated ethanes							
1,2-Dichloroethane			0 (9.4 ug/L)	(9.4 ug/L)	Insufficient data		
1,1,1-Trichloroethane			18.4 mg/L	(19 mg/L)			1.07
1,1,2-Trichloroethane			0 (6.0 ug/L)	(6 ug/L)			
1,1,2,2-Tetrachloroethane			0 (1.7 ug/L)	(1.7 ug/L)			
Hexachloroethane			0 (19 ug/L)	(24 ug/L)			
Monochloroethane			Insufficient data	Insufficient data			
1,1-Dichloroethane			Insufficient data	Insufficient data			
1,1,1,2-Tetrachloroethane			Insufficient data	Insufficient data			
Pentachloroethane			Insufficient data	Insufficient data			

Table 3-2 (Cont'd)

Chemical	Applicable or Relevant Requirements: Safe Drinking Water Act, MCLs, (mg/L unless otherwise noted)	Other Criteria, Advisories, and Guidance: Clean Air Act, NAAQS (ug/m^3)	Clean Water Act, Water Quality Criteria for Human Health Fish and Drinking Water	Clean Water Act, Water Quality Criteria for Human Health Drinking Water Only	Safe Drinking Water Act; Health Advisories (mg/L) 1-day	10-day	Chronic (weeks or months)
Chlorinated naphthalenes			Insufficient data	Insufficient data			
Chlorinated phenols							
3-Monochlorophenol			0.1 ug/L (organoleptic)	0.1 ug/L (organoleptic)			
4-Monochlorophenol			0.1 ug/L (organoleptic)	0.1 ug/L (organoleptic)			
2,3-Dichlorophenol			0.04 ug/L (organoleptic)	0.04 ug/L (organoleptic)			
2,5-Dichlorophenol			0.5 ug/L (organoleptic)	0.5 ug/L (organoleptic)			
2,6-Dichlorophenol			0.2 ug/L (organoleptic)	0.2 ug/L (organoleptic)			
3,4-Dichlorophenol			0.3 ug/L (organoleptic)	0.3 ug/L (organoleptic)			
2,3,4,6-Tetrachlorophenol			1.0 ug/L (organoleptic)	1.0 ug/L (organoleptic)			
2,4,5-Trichlorophenol			2600 ug/L	2600 ug/L			
2,4,6-Trichlorophenol			0. (12 ug/L)	(18 ug/L)			
2-Methyl-4-chlorophenol			1800 ug/L (organoleptic)	1800 ug/L (organoleptic)			
3-Methyl-4-chlorophenol			3000 ug/L (organoleptic)	3000 ug/L (organoleptic)			
3-Methyl-6-chlorophenol			20 ug/L (organoleptic)	20 ug/L (organoleptic)			
Chlorophenoxys							
2,4-Dichlorophenoxyacetic acid	0.1						
2,4,5-Trichlorophenoxy-propionic	0.01						
Chloroalkyl ethers							
bis-(Chloromethyl) ether			0 (0.038 ng/L)	(0.039 ng/L)			
bis-(2-Chloroethyl) ether			0 (0.3 ug/L)	(0.3 ug/L)			
bis-(2-Chloroisopropyl) ether			34.7 ug/L	34.7 ug/L			
Chloroform	0.1[d]		0 (1.90 ug/L)	(1.90 ug/L)			
2-Chlorophenol			0.1 ug/L (organoleptic)	0.1 ug/L (organoleptic)			
Chromium Cr+6	0.05		50 ug/L	50 ug/L			
Cr+3			170 mg/L	170 mg/L			
Copper			1 mg/L (organoleptic)	1 mg/L (organoleptic)			
Cyanide			200 ug/L	200 ug/L			
DDT			0 (0.24 ng/L)	(42 ng/L)			
Dichlorobenzenes (all isomers)			400 ug/L	470 ug/L			
Dichlorobenzidines			0 (0.103 ug/L)	(0.207 ug/L)			
Dichloroethylenes							
1,1-Dichloroethylene			0 (0.33 ug/L)	0.33 ug/L)			
1,2-Dichloroethylene			Insufficient data	Insufficient data	1.0 4.0 2.7	0.4 0.27	0.07 (cis isomer) (trans

Table 3-2 (Cont'd)

Chemical	Applicable or Relevant Requirements: Safe Drinking Water Act, MCLs, (mg/L unless otherwise noted)	Other Criteria, Advisories, and Guidance: Clean Air Act, NAAQS (ug/m³)	Clean Water Act, Water Quality Criteria for Human Health Fish and Drinking Water	Clean Water Act, Water Quality Criteria for Human Health Drinking Water Only	Safe Drinking Water Act, Health Advisories (mg/L): 1-day	10-day	Chronic (weeks or months)
Dichloromethane			See Halomethanes	See Halomethanes	13	1.3	0.15
2,4-Dichlorophenol			0.3 ug/L (organoleptic)	0.3 ug/L (organoleptic)			
Dichloropropanes/ Dichloropropenes							
Dichloropropanes			Insufficient data	Insufficient data			
Dichloropropenes			87 ug/L	87 ug/L			
1,2-Dichloropropane					0.1	0.1	
Dieldrin			0 (0.71 ng/L)	(11 ng/L)			
2,4-Dimethylphenol			400 ug/L (organoleptic)	400 ug/L (organoleptic)			
2-4-Dinitrotoluene			0 (1.1 ug/L)	(1.1 ug/L)			
p-Dioxane						5.68	0.568
1,2-Diphenylhydrazine			0 (422 ng/L)	(455 ng/L)			
Endosulfan			74 ug/L	138 ug/L			
Endrin	0.0002		1 ug/L	1 ug/L			
Ethylbenzene			1.4 mg/L	2.4 mg/L			
Ethylene glycol					19.0		5.5
Formaldehyde						0.030	
Fluoranthene			42 ug/L	188 ug/L			
Fluoride	1.4-2.4						
Haloethers			Insufficient data	Insufficient data			
Halomethanes			0 (1.9 ug/L)	(1.9 ug/L)			
Heptachlor			0 (2.78 ng/L)	(112 ng/L)			
Hexachlorobutadiene			0 (4.47 ug/L)	(4.47 ug/L)			
Hexachlorocyclohexanes							
Lindane (99% gamma-HCH)	0.004						
alpha-HCH			0 (92 ng/L)	(130 ng/L)			
beta-HCH			0 (163 ng/L)	(232 ng/L)			
gamma-HCH			0 (186 ng/L)	(264 ng/L)			
delta-HCH			Insufficient data	Insufficient data			
epsilon-HCH			Insufficient data	Insufficient data			
Technical-HCH			0 (123 ug/L)	(174 ng/L)			
Hexachlorocyclopentadiene			206 ug/L	206 ug/L			
n-Hexane						5.68	0.568
Hydrocarbons (non-methane)		160 (3-hour)[c/e]					
Isophorone			5.2 mg/L	5.3 mg/L			
Kerosene						0.35[f] 0.025	

Chemical	Applicable or Relevant Requirements: Safe Drinking Water Act, MCLs, (mg/L, unless otherwise noted)	Applicable or Relevant Requirements: Clean Air Act NAAQS (ug/m^3)	Other Criteria, Advisories, and Guidance: Clean Water Act, Water Quality Criteria for Human Health Fish and Drinking Water	Other Criteria, Advisories, and Guidance: Clean Water Act, Water Quality Criteria for Human Health Drinking Water Only	Safe Drinking Water Act, Health Advisories (mg/L): 1-day	Safe Drinking Water Act, Health Advisories (mg/L): 10-day	Safe Drinking Water Act, Health Advisories (mg/L): Chronic (weeks or months)
Lead	0.05	1.5 (90-day)	50 ug/L	50 ug/L			
Mercury	0.002		144 ng/L	10 ug/L			
Methoxychlor	0.						
Methyl Ethyl Ketone							
Naphthalene			Insufficient data	Insufficient data		7.5	0.750
Nickel			13.4 ug/L	15.4 ug/L			
Nitrate (as N)	10.0						
Nitrobenzene			19.8 mg/L	19.8 mg/L			
Nitrogen dioxide		100 (1-year)[g]					
Nitrophenols							
2,4-Dinitro-o-cresol			13.4 ug/L	13.6 ug/L			
Dinitrophenol			70 ug/L	70 ug/L			
Mononitrophenol			Insufficient data	Insufficient data			
Trinitrophenol			Insufficient data	Insufficient data			
Nitrosamines							
n-Nitrosodimethylamine			0 (14 ng/L)	(14 ng/L)			
n-Nitrosodiethylamine			0 (8 ng/L)	(8 ng/L)			
n-Nitrosodi-n-butylamine			0 (64 ng/L)	(64 ng/L)			
n-Nitrosodiphenylamine			0 (49 ug/L)	(70 ug/L)			
n-Nitrosopyrrolidine			0 (160 ng/L)	(160 ng/L)			
Ozone		235 (1-hour)					
Particulate Matter		260 (24-hour)[c] 75 (24-hour)[h]					
Pentachlorophenol			1.01 mg/L	1.01 mg/L			
Phenol			3.5 mg/L	3.5 mg/L			
Phthalate esters							
Dimethylphthalate			313 mg/L	350 mg/L			
Diethylphthalate			350 mg/L	434 mg/L			
Dibutylphthalate			34 mg/L	44 mg/L			
Di-2-ethylhexyl-phthalate			15 mg/L	21 mg/L			
Polychlorinated biphenyls (PCBs)			0 (0.79 ng/L)	(>62 ng/L)			
Polynuclear aromatic hydrocarbons (PAHs)			0 (28 ng/L)	(26 ng/L)	0.125	0.0125	

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Table 3-2 (Cont'd)

Chemical	Applicable or Relevant Requirements: Safe Drinking Water Act, MCLs, (mg/L unless otherwise noted)	Applicable or Relevant Requirements: Clean Air Act, NAAQS (ug/m³)	Other Criteria, Advisories, and Guidance: Clean Water Act, Water Quality Criteria for Human Health Fish and Drinking Water	Other Criteria, Advisories, and Guidance: Clean Water Act, Water Quality Criteria for Human Health Drinking Water Only	Safe Drinking Water Act, Health Advisories (mg/L): 1-day	Safe Drinking Water Act, Health Advisories (mg/L): 10-day	Safe Drinking Water Act, Health Advisories (mg/L): Chronic (weeks or months)
Radionuclides							
Radium-226 and 228	5 pCi/L						
Gross alpha activity	15 pCi/L						
Tritium	20,000 pCi/L						
Strontium-90	8 pCi/L						
Other man-made	[i]						
Selenium	0.01		10 ug/L	10 ug/L			
Silver	0.05		50 ug/L	50 ug/L			
Sulfur dioxide		365 (24-hour)[c] 80 (1-year)[g]					
2,3,7,8-TCDD			0 (0.00013 ng/L)	(0.00013 ng/L)			
Tetrachloroethylene			0 (8 ug/L)	(8.8 ug/L)	2.3	0.175	0.02
Thallium			13 ug/L	17.8 ug/L			
Toluene			14.3 mg/L	15 mg/L	21.5	2.2	0.34
Toxaphene	0.005		0 (7.1 ng/L)	(258 ng/L)			
Trichloroethylene			0 (27 ug/L)	(28 ug/L)	2.02	0.2	0.075
Trihalomethanes (total)[j]	0.1						
Vinyl chloride			0 (20 ug/L)	(20 ug/L)			
Xylenes					12	1.3	0.62
Zinc			5 mg/L (organoleptic)	5 mg/L (organoleptic)			

[a] Organoleptic criteria are based on taste and odor effects, not human health effects.

[b] Concentrations in parentheses correspond to carcinogenic risk of 10^{-5}.

[c] Annual maximum concentration not to be exceeded more than one per year.

[d] Chloroform is one of four trihalomethanes whose sum concentration must be less than 0.1 mg/L.

[e] As a guide in devising implementation plans for achieving oxidant standards.

[f] Seven-day health advisory for benzene and benzo(a)pyrene, respectively.

[g] Annual arithmetic mean concentration.

[h] Annual geometric mean concentration.

[i] Activity corresponding to total body or any internal organ dose of 4 mrem/year.

[j] Total trihalomethanes refers to the sum concentration of chloroform, bromodichloromethane, dibromochloromethane, and bromoform.

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3.2.2 CONTAMINANT CRITERIA FOR GROUNDWATER

Water quality standards have been developed over the years that provide a partial basis for assessing the level and significance of groundwater contamination at the South Cavalcade Street Site. No set of environmental standards is comprehensive, however; and acceptable standards for all possible compounds, particularly organic compounds, that might be found in the groundwater have not been developed.

The principal standards that will be used in evaluating contamination in the groundwater at the South Cavalcade Street Site will be the available drinking water standards. Although the shallow aquifer is not currently being used as a drinking water source, it is a potential source and therefore constitutes a Class 2 Aquifer under EPA's groundwater protection strategy. The deeper aquifer is being used as a domestic water supply and also is a Class 2 Aquifer. At sites that overlie Class 2 groundwaters, the goal of CERCLA cleanups is to provide drinking water quality or background levels, as appropriate. Background water quality will be determined during the field investigations and compared to Texas Department of Health drinking water standards. This comparison will result in a list of contaminant cleanup levels which are to be achieved. Table 3-3 presents the maximum allowable limits for various compounds in drinking water as promulgated by the Texas Department of Health. The table also lists secondary criteria which are intended for guidance but not as absolute limits.

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3.2.3 CONTAMINANT CRITERIA FOR SOILS

The significance of contamination of soils and non-soils materials will be evaluated based on their potential exposure pathways. These include the potential for the contaminants to be released to and migrate with air, surface water, or groundwater at the South Cavalcade Street Site and the subsequent potential for human and environmental exposure through dermal, ingestion, or inhalation routes. Detection of contamination visually, with the olfactory senses, or field instruments will be considered adequate to ascertain that the soils materials and non-soil material are contaminated.

TABLE 3-3

Texas Department of Health Drinking Water Standards
Maximum Allowable Limits

Parameter	Limit (mg/L)	Limit (ug/L)	Limit (other)
Inorganic			
Arsenic	0.05	50	
Barium	1	1,000	
Cadmium	0.010	10	
Chromium	0.05	50	
Lead	0.05	50	
Mercury	0.002	2	
Nitrate (as N)	10	10,000	
Selenium	0.01	10	
Silver	0.05	50	
Organic			
Endrin	0.0002	0.2	
Lindane	0.004	4	
Methoxychlor	0.1	100	
Toxaphene	0.005	5	
2,4-D	0.1	100	
2,4,5-TP (Silvex)	0.01	10	
Total trihalomethanes	0.1	100	
Secondary Constituents			
Copper	1.0	1,000	
Iron	0.3	300	
Manganese	0.05	50	
Zinc	5.0	5,000	
Chloride	300	300,000	
Sulfate	300	300,000	
Hydrogen Sulfide	0.05	50	
Foaming agents	0.5	500	
Total Dissolved Solids	1,000	1,000,000	
pH			>7.0
Color			15 color units
Odor			3 threshold odor number
Corrosivity			Noncorrosive

From Texas Department of Health, Division of Water Hygiene, Drinking Water Standards Governing Drinking Water Quality and Reporting Requirements for Public Water Supply System (Adopted 4 June 1977, Revised 29 Nov 1980).

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These qualitative determinations will be substantiated with an evaluation of the basic processes involved in wood preserving operations, the physical and chemical properties of the materials used to treat the lumber, and with such tests as the EP toxicity. Unfortunately, there are no currently promulgated environmental criteria or standards for contaminants in soils, except for PCB-contaminated soils which are subject to TSCA limits. It will, therefore, be necessary to consult with EPA to review the Endangerment Assessment and determine an appropriate range of cleanup levels for contaminated soils at the South Cavalcade Street Site.

3.2.4 CONTAMINANT CRITERIA FOR SURFACE WATER

The principal criteria for surface water are water quality standards promulgated by EPA and the State of Texas to protect the public health or welfare and enhance water quality. Toxic pollutants are emphasized by current EPA regulations as the basis for permit limitations under the National Pollutant Discharge Elimination System. However, Texas standards do not include numerical criteria for many toxic chemicals, although there is a general narrative requirement that waters must not contain toxic substances in toxic amounts. In the absence of state numerical criteria, EPA water quality criteria will be used as the basis for evaluating cleanup actions at the South Cavalcade Street Site. These criteria are listed on Table 3-4. Final cleanup levels for the site will be based on the numerical criteria and review of the Endangerment Assessment with EPA. Additionally, the drinking water standards listed in Table 3-3 will also be applicable to surface water.

3.2.5 CONTAMINANT CRITERIA FOR AIR QUALITY

Air emissions from the South Cavalcade Street Site produces no significant impact to contiguous areas. The site, located in greater Houston (Harris County), has an air qualty consistent with other areas of the city. The site location is in an area classified as nonattainment (not presently meeting national ambient air quality standard - NAAQS) for both ozone and total suspended particulates. The greater Houston area is classified as being in attainment for sulfur dioxide, nitrogen oxides and carbon

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TABLE 3-4

U.S. Environmental Protection Agency
Water Quality Criteria and Detection Limits

PARAMETER	AQUATIC LIFE CRITERIA* FRESH WATER	SALT WATER	HUMAN HEALTH CRITERIA**	DETECTION LIMIT+
Acenaphthene	1,700 ug/l(A)	970 ug/l(A); 710 ug/l(Ch)	20 ug/l (O)	3 ug/l
Acrolein	68 ug/l(A); 21 ug/l (Ch)	55 ug/l(A)	320 ug/l (T)	2 ug/l
Acrylonitrile	7,500 ug/l(A)	-	0.58 ug/l (C)	100 ug/l
Aldrin	3 ug/l max (A)	1.3 ug/l max (A)	0.00074 ug/l (C)	0.003 ug/l
Dieldrin	0.0019 ug/l (24 hr)	0.0019 ug/l (24 hr)	0.00071 ug/l (C)	0.006 ug/l
Antimony	9,000 ug/l(A), and (Ch)	-	146 ug/l (T)	3 ug/l
Arsenic	440 ug/l (max)	508 ug/l(A)	0.022 ug/l (C)	53 ug/l
Asbestos	-	-	300,000 fbr/l (C)	100,000 fbr/l
Benzene	5,300 ug/l(A)	5,100 ug/l(A)	6.6 ug/l (C)	0.2 ug/l
Benzidine	2,500 ug/l(A)	-	0.0012 ug/l (C)	0.05 ug/l
Beryllium	130 ug/l(A); 5.3 ug/l(Ch)	-	0.037 ug/l (C)	0.3 ug/l
Cadmium	0.012 ug/l (24 hr) 1.5 ug/l (max)	4.5 ug/l 24 hr 59 ug/l (max)	10 ug/l (T)	4 ug/l
Carbon Tetrachloride	35,200 ug/l(A)	50,000 ug/l(A)	4.0 ug/l (C)	0.007 ug/l
Chlordane	0.0043 ug/l (24 hr) 2.4 ug/l (max)	0.004 ug/l (24 hr) 0.09 ug/l (max)	0.0046 ug/l (C)	0.4 ug/l
Chlorinated Benzenes:	250 ug/l(A)	129 ug/l(A,Ch)		
monochlorobenzene			488 ug/l (T) 20 ug/l (O)	0.03 ug/l
1,2,4,5-tetrachlorobenzene			38 ug/l (T)	
pentachlorobenzene			74 ug/l (T)	
hexachlorobenzene			0.0072 ug/l (C)	0.001 ug/l
Chlorinated Ethanes:				
1,2-dichloroethane	118,000 ug/l(A);20,000 ug/l(Ch)	113,000 ug/l(A)	9.4 ug/l (C)	0.006 ug/l
1,1,1-trichloroethane	18,000 ug/l(A);9,400 ug/l(Ch)	31,200 ug/l(A)	184000 ug/l (T)	0.005 ug/l
1,1,2-trichloroethane	18,000 ug/l (A)		6 ug/l (C)	0.006 ug/l
1,1,2,2-tetrachloroethane	9,320 ug/l(A);2,400 ug/l (Ch)	9,020 ug/l (A)	1.7 ug/l (C)	0.006 ug/l
pentachloroethane	7,240 ug/l(A);1100 ug/l (Ch)	390 ug/l(A);281 ug/l(Ch)		
hexachloroethane	980 ug/l(A);540 ug/l(Ch)	940 ug/l(A)	19 ug/l (C)	0.001 ug/l
Chlorinated Napthalenes	1,600 ug/l(A)	7.5 ug/l(A)	-	0.015 ug/l
Chlorinated Phenols:				
3-monochlorophenol	500,000 ug/l(A)		0.1 ug/l (O)	
4-monochlorophenol	500,000 ug/l(A)	29,700 ug/l(A)	0.1 ug/l (O)	

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TABLE 3-4
(Continued)

PARAMETER	AQUATIC LIFE CRITERIA* FRESH WATER	SALT WATER	HUMAN HEALTH CRITERIA**	DETECTION LIMIT+
2,5-dichlorophenol	500,000 ug/l(A)		0.5 ug/l (O)	
2,6-dichlorophenol	500,000 ug/l(A)		0.2 ug/l (O)	
3,4 dichlorphenol	500,000 ug/l(A)		0.3 ug/l (O)	
2,4,5-trichlorophenol	500,000 ug/l(A)		2600 ug/l (T) 1 ug/l (O)	
2,4,6-trichlorophenol	970 ug/l(Ch)		12 ug/l (C) 2 ug/l (O)	5 ug/l
2,3,4,6-tetrachlorophenol	500,000 ug/l(A)		1 ug/l (O)	
2,3,5,6-tetrachlorophenol		440 ug/l(A)	1800 ug/l (O)	
2-methyl-4-chlorophenol			1800 ug/l (O)	
3-methyl-4-chlorophenol	500,000 ug/l(A)		3000 ug/l (O)	8.3 ug/l
3-methyl-6-chlorophenol	500,000 ug/l(A)		20 ug/l (O)	
Chloroalkyl Ethers:	238,000 ug/l(A)			
bis (2-chloroisopropyl) ether			34.7 ug/l (T)	0.9 ug/l
bis (chloromethyl) ether			0.000038 ug/l (C)	0.4 ug/l
bis (2-chloroethyl) ether			0.3 ug/l (C)	0.5 ug/l
Chloroform	28,900 ug/l(A); 1,240 ug/l(Ch)		1.9 ug/l (C)	0.006 ug/l
2-Chlorophenol	4,380 ug/l(A)		0.1 ug/l (O)	2 ug/l
Chromium VI	0.29 ug/l (24 hr) 21 ug/l (max)	18 ug/l (24 hr) 1260 ug/l (max)	50 ug/l (T)	7 ug/l
Chromium III	2200 ug/l (max)		170000 ug/l (T)	7 ug/l
Copper	5.6 ug/l (24 hr) 12 ug/l (max)	4 ug/l (24 hr) 23 ug/l (max)	1000 ug/l (O)	6 ug/l
Cyanide	3.5 ug/l (24 hr) 52 ug/l (max)		200 ug/l (T)	5 ug/l
DDT	0.001 ug/l (24 hr) 1.1 ug/l (max)	0.001 ug/l (24 hr) 0.13 ug/l (max)	0.00024 ug/l (C)	0.016 ug/l
Dichlorobenzenes	1120 ug/l(A); 763 ug/l(Ch)	1,970 ug/l(A)	400 ug/l(A)	0.009 ug/l
Dichlorobenzidine			0.103 ug/l (C)	0.1 ug/l
1,1-Dichloroethylene	11,600 ug/l(A)	224,000 ug/l(A)	0.33 ug/l (C)	0.006 ug/l
2,4-Dichlorophenol	2,000 ug/l(A); 365 ug/l(Ch)		0.3 ug/l (O)	2.1 ug/l
Dichloropropanes	23,000 ug/l(A); 5700 ug/l(Ch)	10,300 ug/l(A); 3,040 ug/l(Ch)		
Dichloropropenes	6,060 ug/l(A); 244 ug/l(Ch)	790 ug/l(A)	87 ug/l (T)	0.006 ug/l
2,4-Dimethylphenol	2,120 ug/l(A)		400 ug/l (O)	1.7 ug/l
2,4-Dinitrotoluene	330 ug/l(A); 230 ug/l(Ch)	590 ug/l(A)	1.1 ug/l (C)	0.06 ug/l
1,2-Diphenylhydrazine	270 ug/l(A)		0.4 ug/l (C)	10 ug/l
Endosulfan	0.056 ug/l (24 hr) 0.22 ug/l (max)	0.0087 ug/l (24 hr) 0.034 ug/l (max)	74 ug/l (T)	0.005 ug/l

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TABLE 3-4
(Continued)

PARAMETER	AQUATIC LIFE CRITERIA* FRESH WATER	SALT WATER	HUMAN HEALTH CRITERIA**	DETECTION LIMIT+
Endrin	0.0023 ug/l (24 hr) 0.18 ug/l (max)	0.0023 ug/l (24 hr) 0.037 ug/l (max)	1 ug/l (T)	0.009 ug/l
Ethylbenzene	32,000 ug/l(A)	430 ug/l(A)	1400 ug/l (T)	10 ug/l
Fluoranthene	3,980 ug/l(A)	40 ug/l(A); 16 ug/l(Ch)	42 ug/l (T)	0.05 ug/l
Haloethers	360 ug/l(A); 122 ug/l(Ch)			0.06 ug/l
Halomethanes	11,000 ug/l (A)	12,000(A); 6,400 ug/l(Ch)	#1.9 ug/l (C)	0.01 ug/l
Heptachlor	0.0038 ug/l (24 hr) 0.52 ug/l (max)	0.0036 ug/l (24 hr) 0.053 ug/l (max)	0.00278 ug/l (C)	0.002 ug/l
Hexachlorobutadiene	90 ug/l(A); 9.3 ug/l(Ch)	32 ug/l (A)	4.47 ug/l (C)	0.001 ug/l
Hexachlorocyclohexane				
alpha-BHC	100 ug/l(A)	0.34 ug/l(A)	0.092 ug/l (C)	0.002 ug/l
beta-BHC	100 ug/l(A)	0.34 ug/l	0.163 ug/l (C)	0.004 ug/l
gamma-BHC (lindane)	0.08 ug/l (24 hr) 2 ug/l (max)	0.16 ug/l (max)	0.186 ug/l (T)	0.002 ug/l
tech BHC			0.123 ug/l (C)	0.004 ug/l
Hexachlorocyclopentadiene	7.0 ug/l(A); 5.2 ug/l(Ch)	7.0 ug/l	206 ug/l (T) 1 ug/l (O)	0.001 ug/l
Isophorone	117,000 ug/l(A)	12,900 ug/l(A)	5,200 ug/l (T)	5 ug/l
Lead	0.75 ug/l (24 hr) 74 ug/l (max)	668 ug/l(A); 25 ug/l(Ch)	50 ug/l (T)	42 ug/l
Mercury (Total Recoverable)	0.00057 ug/l (24 hr) 0.0017 ug/l (max)	0.025 ug/l (24 hr) 3.7 ug/l (max)	0.144 ug/l (T)	0.4 ug/l
Napthalene	2,300 ug/l(A); 620 ug/l(Ch)	2,350 ug/l(A)		2.5 ug/l
Nickel	56 ug/l (24 hr) 1100 ug/l (max)	7.1 ug/l (24 hr) 140 ug/l (max)	13.4 ug/l (T)	15 ug/l
Nitrobenzene	27,000 ug/l(A)	6,680 ug/l(A)	19800 ug/l (T) 30 ug/l (O)	5 ug/l
Nitrophenols	230 ug/l(A)	4,850 ug/l(A)		
2,4-dinitro-o-cresol			13.4 ug/l (T)	
dinitrophenol			70 ug/l	7 ug/l
Nitrosamines:	5,850 ug/l(A)	3,300,00 ug/l(A)		
N-nitrosodimethylamine			0.014 ug/l (C)	0.3 ug/l
N-nitrosodiethylamine			0.008 ug/l (C)	
N-nitrosodi-n-butylamine			0.064 ug/l (C)	
N-nitrosopyrrolidine			0.160 ug/l (C)	
N-nitrosodiphenylamine			49 ug/l (C)	1 ug/l
Pentachlorophenol	55 ug/l(A); 3.2 ug/l(Ch)	53 ug/l(A); 34 ug/l(Ch)	1010 ug/l (C)	10 ug/l

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(Continued)

PARAMETER	AQUATIC LIFE CRITERIA* FRESH WATER	SALT WATER	HUMAN HEALTH CRITERIA**	DETECTION LIMIT+
Phenol	10,200 ug/l(A); 2,560 ug/l(Ch)	5,800 ug/l(A,Ch)	3500 ug/l (T)	
Phthalate esters:	940 ug/l(A); 3 ug/l (Ch)	2,944 ug/l(A)		
dimethyl phthalate			313000 ug/l (T)	0.11 ug/l
diethyl phthalate			350000 ug/l (T)	0.13 ug/l
dibutyl phthalate			34000 ug/l (T)	0.02 ug/l
di-2-ethylhexyl phthalate			15000 ug/l (T)	0.04 ug/l
PCB's	0.014 ug/l (24 hr)	0.03 ug/l (24 hr)	0.00079 ug/l (C)	0.04 ug/l
PAH's (polynuclear aromatic hydrocarbons)		300 ug/l (max)	0.028 ug/l (C)	0.04 ug/l
Selenium	35 ug/l (24 hr) 260 ug/l (max)	54 ug/l (24 hr) 410 ug/l (max)	10 ug/l (T)	75 ug/l
Silver	1.2 ug/l (max)	2.3 ug/l (max)	50 ug/l (T)	7 ug/l
TCDD			2.1x10 ug/l (C)	0.003 ug/l
Tetrachloroethylene	5,280 ug/l(A); 840 ug/l(Ch)	10,200 ug/l(A); 450 ug/l(Ch)	8 ug/l (C)	0.007 ug/l
Thallium	1,400 ug/l(A); 40 ug/l(Ch)	2,130 ug/l(A)	13 ug/l (T)	1 ug/l
Toluene	17,500 ug/l(A)	6,300(A); 5,000 ug/l(Ch)	14,300 ug/l (T)	10 ug/l
Toxaphene	0.013 ug/l (24 hr) 1.6 ug/l (max)	0.07 ug/l (max)	0.0071 ug/l (C)	0.4 ug/l
Trichloroethylene	45,000 ug/l(A)	2,000 ug/l(A)	27 ug/l (C)	0.005 ug/l
Vinyl Chloride			20 ug/l (C)	0.01 ug/l
Zinc	47 ug/l (24 hr) 180 ug/l (max)	58 ug/l (24 hr) 170 ug/l (max)	5000 ug/l (O)	2 ug/l

* Criteria as published in Fed. Reg. 45: 79318 and Fed. Reg. 46: 40919. Criteria for hardness-related metals assumes 50 mg/l $CaCO_3$ = most strigent criteria. 24 hr = 24 hour average value; max = value not to be exceeded at any time.

** Criteria as published in Fed. Reg. 45: 79318 and Fed. Reg. 46: 40919. Basis for criteria designated as follows: A=acute toxicity; C=carcinogenicity at the 10^{-5} risk level; Ch=chronic toxicity; O=Organoleptic effect; T=toxicity.

\+ Detection limits as published in Fed. Reg. 44: 69464.

\# For the following halomethanes: Chloromethane, dichloromethane, bromomethane, tribromomethane, bromodichloromethane, dichlorodifluoromethane, trichlorofluoromethane, or combinations of these compounds.

monoxide. The existing trucking operations may contribute in small quantities to the nitrogen oxides and carbon monoxide levels.

No direct sources of air contamination from the previous creosoting and wood preserving operations exist. All potential disposal and operations areas are presently covered with fill or vegetation. This provides a barrier which prevents direct contact between these potential sources and the air. Although waste products from this site contain odorous compounds that would degrade ambient air quality, this barrier prevents diffusion of these compounds into the ambient atmosphere. Only upon exposure of the underlying contaminated soils through investigation and/or construction activities could air quality degradation in the immediate area possibly occur. As discussed previously, the waste creosote products disposal at this site appear to have been subjected to environmental degradation; available data suggest that only refractory non-volatile compounds remain. As a result, no major concentrations of volatile organics which might influence the ambient atmosphere are expected. Thus, no significant impact to local or regional air quality is expected.

In the event that remedial action at the site involves excavation, federal and state air quality regulations must be followed. Tables 3-5 through 3-7 below summarize the federal and state standards on air pollutants of potential concern at this site.

If incineration is included as part of a remedial action, federal and state emissions standards as well as ambient air quality standards must be addressed. Table 3-7 outlines federal and state emissions regulations concerning the pollutants that may be of concern at this site.

3.3 PRELIMINARY IDENTIFICATION OF DATA GAPS AND ISSUES RELATED TO EVALUATING ALTERNATIVES

For each of the identified Remedial Alternatives, the data required to assess, screen, and evaluate the alternatives have been identified. These data requirements have been compared to the existing information in order to delineate supplemental data needs. Composite requirements of the

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TABLE 3-5 FEDERAL AMBIENT AIR QUALITY STANDARDS[a]

Pollutant	Averaging Time	Primary Standard	Secondary Standard	Measurement Method
Suspended particulate matter	Annual geometric mean	75 ug/m^3	60 ug/m^3	High-volume sampling
	24 hr	260 ug/m^3	150 ug/m^3	
Lead	3 months	1.5 ug/m^3	Same	High-volume sampling

Source: Federal Register 36, no. 84, Part II, April 30, 1971, pp. 8186 - 8201 [11]; 43, September, 1978, p. 46246.

[a]Standards, other than those based on annual average or annual geometric average, are not to be exceeded more than once a year.

Note: Primary standards refer to concentrations which are an immediate threat to public health. Secondary standards are to protect the public from known or anticipated adverse effects.

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TABLE 3-6 STATE AMBIENT AIR QUALITY STANDARDS

Pollutants	Averaging Time	Level 1	Level 2	Measurement Method
Particulates	24 hour	750 ug/m^3	1000 ug/m^3	High-volume sampling
Opacity	5 min.	20 percent		Light Transmittance Measuring Device

Source: Texas Air Control Board Regulations

Note: Level 1 refers to the concentration of a given pollutant which will prompt an investigation into the source of that pollutant (minor public health threat). Level 2 refers to the concentration of a pollutant which will prompt an order to cease operations at the probable source(s) (major public health threat).

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TABLE 3-7 STATE AND FEDERAL EMISSION REGULATIONS

Pollutant	Federal Standard	State Standard
Particulates	2 hr. avg. = 18 ug/m^3 max.[1] corrected to 12 percent CO_2	5 min. avg. = opacity of 15 percent max.[2]
Lead[3]	2 min. avg. = 50 ug/m^3 max. 10 percent opacity max.	0.4 lb/hour

[1] Solid waste burned exceedign 50 tons/day
[2] Flowrate exceeding 100,000 acfm from flue.
[3] From lead smeltering operations.

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alternatives have been used to formulate the site investigation activities. Basic data requirements are as follows:

- Surface Water/Surface Sediment
  - -- Quality of surface runoff at various locations
  - -- Quality of water ponded on the site after a rainfall event
  - -- Kinds and levels of contamination associated with surface drainage courses on and adjacent to the site
- Surface Soils/Non-Soil Materials
  - -- Better definition of the stratigraphy of soils materials beneath the site
  - -- Better definition of the nature and the extent of contamination of soils materials and buried non-soils materials on the site
  - -- Adequate characterization of the kinds and volumes of contaminated material on the site
  - -- Adequate definition of the mechanisms and pathways of contaminant migration
- Shallow Groundwater
  - -- Characterization of the hydrology of the shallow aquifer
  - -- Documentation of the use or potential use of water from the shallow aquifer
  - -- Determination of the physical properties of the shallow aquifer
  - -- Documentation of the short-term, seasonal, and long-term trends in behavior of the shallow aquifer system
  - -- Documentation of the natural quality of groundwater in the shallow aquifer
  - -- Determination of the kinds and levels of contamination in the shallow aquifer
  - -- Evaluation of the source of contamination in the shallow aquifer
  - -- Delineation of discharge permits from the shallow aquifer
- Deeper Groundwater
  - -- Characterization of the Aquitard
  - -- Determination of the kind and level of contamination in the deeper groundwater, if any
  - -- Determination of the potential for contamination of the deeper aquifer
  - -- Documentation of the uses of groundwater from the deeper aquifer and the points of withdrawal
- Air Quality
  - -- Determination of the kinds and levels of air emissions that might be associated with excavation of contaminated soils and non-soil materials

3.4 OVERALL APPROACH TO ALTERNATIVES EVALUATION

The Remedial Alternatives for the South Cavalcade Street Site will be evaluated and compared using the criteria described in Section 3.2 and

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factors related to technical feasibility, institutional concerns, public health risks, environmental assessment, and costs.

3.4.1 TECHNICAL FEASIBILITY

Alternative remedial actions will be evaluated for technical feasibility to determine if the suggested technologies are appropriate to site conditions. The technical feasibility evaluation will include analyses of performance, reliability, implementability, and safety for each alterantive.

<u>Performance</u>

The performance evaluation will include an analysis of the effectiveness and useful life of each alternative to determine their overall desirability. Effectiveness will include an evaluation in terms of the ability to perform intended functions, such as containment, diversion, removal, destruction, or treatment. The effectiveness will be determined either through design specifications or by performance evaluation. Design specifications will be compared to established numerical criteria given in Section 3.2 as they are being applied to the site based on consultations with EPA. For situations where numerical standards are not available, performance specifications will be developed based on best professional judgment and used in evaluating alternatives. Preference will be given to those technologies that completely immobilize, destroy, or recycle the hazardous material.

Most remedial technologies deteriorate with time and eventually may require replacement. Each alternative will be evaluated in terms of the projected service life of its component technologies, and the costs of operation and maintenance. Considerations for the future, such as resource availability and appropriateness of the technologies, will also be included in estimating the useful life.

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Reliability

Reliability aspects of the technical feasibility analysis will include evaluations of operation and maintenance (O & M) requirements and performance demonstrated at similar sites. O & M evaluations will include the frequency and complexity of O & M functions, availability of capable operating personnel, and availability of key materials such as treatment chemicals. In general, technologies that require frequent or complex O & M activities will be considered less reliable than technologies requiring fewer or less complex O & M.

Reliability of performance will be based on estimates of probability of failure for each component technology and for the complete alternative. Preference will be given to technologies which have proven effective under similar waste and site conditions. Requirements for bench-scale and pilot plant studies will also be considered. Technical analyses will not be based on presumed performance of untested methods.

Implementability

The implementability of each alternative will be evaluated in terms of the relative ease of installation and the time required to achieve a given level of response. Ease of installation will be based on a constructability assessment, or the ability to actually construct or implement the remedial technology. Considered will be the ability to obtain necessary permits, the availability and acceptability of alternative disposal sites, and the equipment available for construction. The time required to implement a remedy and the time required to actually see beneficial effects will be considered. Also assessed will be the benefits of phasing and segmenting the components of the remedial action and the long-term management requirements.

Safety

Each remedial alternative will be evaluated with regard to safety. This evaluation will include threats to safety of nearby communities and the environment as well as to workers during implementation. Major risks that will be considered during the technical feasibility analysis are fire, explosion, and exposure to hazardous substances. Other safety concerns will be addressed as part of the broader public health risk evaluation described in Section 3.4.3.

3.4.2 INSTITUTIONAL CONCERNS

Federal, state, and local environmental and public health standards, regulations, guidance, advisories, or ordinances may influence remedial alternatives by requiring or providing guidance on design, operation, and levels of cleanup or discharge. These institutional issues will be evaluated as part of the remedial alternatives analysis.

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It is EPA policy that primary consideration be given to remedial actions that comply with applicable or relevant public health standards. The effects of these standards, which were generally described in Section 3.2, will be evaluated so they relate to the design, operation, and timing of each alternative. If an alternative does not comply with applicable or relevant standards, it will be evaluated to determine if it conforms to one of the five permissible exceptions allowed by EPA. If the standards are exceeded by the alternative, the state participation role will be determined or assessed. All applicable or relevant public health and environmental standards, interagency coordination needs, and other institutional issues will also be identified, and the results of the institutional analysis of each remedial alternative will be included in the feasibility study.

3.4.3 PUBLIC HEALTH RISKS

Each alternative remedial action will be evaluated to determine how well the actions limit the concentrations of toxic substances in the environment and avoid unacceptable threats to human health. The public health risks will be determined from the results of a baseline site evaluation, an exposure assessment, and a standards analysis.

Baseline Site Evaluation

The first step in the public health risk evaluation will be the collection, organization, and review of available data relevant to public health applicable to each alternative proposed for the South Cavalcade Street Site. Most of these data will be collected during the detailed field investigations and compiled during the endangerment assessment described in Section 4.0. Each alternative will also be classified as either source control options, which address onsite contamination, or management of migration options, which address off-site contamination. Each of the remedial alternatives will undergo a qualitative baseline evaluation on their potential public health threats in the absence of remedial action, considering the types and amounts of chemicals at the site, their toxic effects, the proximity of target populations, the likelihood of chemical release and migration from the site, and the potential for exposure.

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Exposure Assessment

Selecting the appropriate remedial action requires assessing exposure and comparing it to ambient environmental standards. For each alternative, the frequency, magnitude, and duration of human exposure to toxic chemical contaminants released from the site will be assessed. This assessment will be an alternative-specific exposure evaluation whereas the endangerment assessment described in Section 4.0 pertains to the site as a whole. For each alternative, the frequency, magnitude, and duration of human exposure to toxic chemical contaminants released from the South Cavalcade Street Site will be estimated. This assessment will include identifying chemicals present at the site and selecting indicator chemicals; identifying points of potential human exposure and exposure pathways for each remedial alternative; characterizing populations potentially at risk; and estimating at all exposure points the environmental concentrations of each indicator substance for each remedial alternative.

Standards Analysis

Following the exposure assessment, estimated environmental concentrations of indicator chemicals will be compared to the applicable or relevant standards and criteria described in Section 3.2. From this comparison an evaluation will be made of each alternative action to determine if the standards and criteria will be met. Each alternative will then be classified as either meeting, exceeding, or not meeting relative or applicable concentration limits.

3.4.4 ENVIRONMENTAL ASSESSMENT

An environmental assessment will be prepared for each alternative action, which will focus on the site problems and pathways of contamination actually posed by each alternative. A detailed analysis of environmental effects will be performed only when they are within the scope of the alternatives. However, any known environmental problems not addressed by the remedial alternatives will be clearly identified. Three main issues that will be considered when assessing the environmental effects of each alternative are the adverse impacts, level of detail required, and scope of the assessment.

Environmental Assessment of Adverse Impacts

The first step will be an environmental assessment of the "No Action" alternative. This environmental assessment will include a description of the current site and the environmental conditions anticipated if no remedial actions are taken. This assessment will determine the value (or uses) of the areas that are contaminated or threatened with contamination; identify the types of impacts that are likely with no action; and assess the general significance of the impacts.

Following the "No Action" assessment, a similar environmental impact evaluation will be performed for each alternative remedial action. However, the detailed assessment will be performed if the alternative action results in any of the following:

- A substantial increase in airborne emissions;
- A new discharge to surface or groundwaters;
- An increase in the volume of loading of a pollutant from existing sources, or a new facility, to receiving waters;
- Known or expected significant adverse effects on the environment or on human use of environmental resources; and
- Known or expected direct or indirect adverse effects on environmentally sensitive resources or areas, such as wetlands, prime and unique agricultural lands, aquifer recharge zones, archeological and historical sites, and endangered or threatened species.

If an alternative does not require a detailed environmental assessment of adverse effects, a statement to that effect will be provided that summarizes the supporting reasoning.

Appropriate Levels of Detail

The appropriate level of detail of the environmental assessment will be adequate to compare the expected environmental benefits of different alternatives meaningfully and to determine the extent of the impacts of construction and operation. The level of detail will be determined based on projected effects to environmentally sensitive areas, potential violation of environmental standards, short and long-term effects, and possible irreversible commitments of resources.

Scope of Environmental Assessment

The environmental assessment will address both long-term and short-term effects, with the detail of analysis dependent upon the degree of impact as described above. Environmental effects of remedial actions may include effects on hydrology, geology, air quality, biology, socioeconomics, land use, and archeological and historic sites. In general, each alternative will be evaluated by considering beneficial effects of the response, such as changes in the release of contaminants and final environmental conditions. Expected adverse effects of construction or operation will also be considered together with related mitigative measures.

3.4.5 COSTS

For each alternative plan remaining after initial screening, detailed costs will be developed and analyzed. This will consist of the preparation of capital and O & M costs, a present worth analysis, and a sensitivity analysis.

Estimation of Costs

All capital and O & M costs for each remedial action will be identified. All cost data will be updated to current dollars as required and normalized if necessary to be specific to the Houston area. Additionally, the life-cycle period of capital and O & M functions will be identified for each component of the alternative plans.

Capital costs items will include both direct (construction) and indirect (nonconstruction and overhead) costs. The direct costs will consist of estimates for equipment, labor, and materials necessary to install initial and future remedial actions. Indirect costs will include expenditures for engineering, financial, and other services not part of actual installation activities but required to complete the installation of remedial alternatives. Also identified will be any capital costs that must increase or occur in future years as part of the remedial action alternative.

Operation and maintenance costs will consist of the post-construction costs necessary to ensure continued effectiveness of a remedial action. The following O & M cost components will be considered:

- Operating labor costs;
- Maintenance materials and labor costs;
- Auxiliary materials and energy;
- Purchased services;

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- Disposal costs;
- Administrative costs;
- Insurance, taxes, and licensing costs; and
- Maintenance reserve and contingency funds.

Also included will be any other O & M cost items which do not fit into the above categories.

Present Worth Analysis

A present worth analysis will be used to evaluate expenditures that occur over different time periods by discounting all future costs to the present. Per EPA guidance, a discount rate of 10 percent before taxes and after inflation will be assumed. For the purpose of the detailed feasibility analysis, the period of performance will not exceed 30 years. The method used in determining the present worth of remedial actions will be consistent with EPA's "Remedial Action Costing Procedures Manual."

Sensitivity Analysis

After the present worth of each remedial action alternative is calculated, each cost will be evaluated for effects of variations in assumptions through sensitivity analysis. The sensitivity analysis will assess the effect that variations in specific assumptions associated with the design, implementation, operation, and effective life of an alternative will have on the estimated cost of the alternative. These assumptions will depend on the accuracy of the data developed during the remedial investigation and on predictions of the future behavior of the remedial technology and are subject to varying degrees of uncertainty. The sensitivity of costs to these uncertainties will be observed by varying these assumptions and noting the effects on estimated costs. Sensitivity analysis will also be used to optimize the design of a remedial action alternative, particularly when design parameters are interdependent (like treatment plant capacity for contaminated groundwater and the length of the period of performance).

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The following factors will be considered in conducting the sensitivity analysis:

- Effective life of remedial action (replacement);
- Operation and maintenance costs;
- Duration of cleanup (period of performance);
- Extent of cleanup, given uncertainty about site conditions;
- Other design parameters; and
- Discount rate.

Emphasis will be given to those factors above which can have a significant effect on overall costs. Other factors given emphasis will be those for which the value is most uncertain. The results of the sensitivity analysis will be used to identify "worst case" scenarios and to revise estimates of contingency or reserve funds associated with each alternative plan.

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3.4.6 COMPARISON OF REMEDIAL ACTION ALTERNATIVES

As each alternative action is evaluated, it will be compared and ranked against the other remedial alternatives using the categories described above. The comparison will include two major analyses, the noncost criteria and the cost criteria.

Noncost Criteria Analysis

The noncost criteria analysis will address considerations of technical feasibility, institutional issues, public health, and environmental protection. This process will eliminate alternatives that are not technically feasible for reasons of performance, reliability, implementability, or safety. Similarly, alternatives will be eliminated that do not meet necessary environmental or public health goals. This will involve the identification of adverse impacts on the environment or on public health or welfare that may preclude the use of each assembled alternative. Adequate protection for purposes of comparison will be considered as a comprehensive response that addresses all pathways and points of exposure. Alternatives that provide similar environmental and public health and welfare benefits will also be identified. Those remedial actions that do not conform to institutional requirements will also be eliminated; however, upon completion of the alternative comparisons, at least one alternative will remain for each of the five categories described in Section 3.1.

Cost Analysis

The purpose of cost screening is to eliminate alternatives that have costs on order of magnitude greater than those of other alternatives, but do not provide greater environmental or public health benefits or greater reliability. To minimize the level of effort required for cost screening, data sources will be limited to the "Remedial Actions Cost Compendium" (ECI, 1964), the remedial investigation, standard cost indicies, and other readily available information. Also, the time for preparing screening cost estimates will be limited to a few days, and cost estimates will be produced within an accuracy of -50 to +100 percent.

The remedial alternatives will be compared on the basis of capital costs, operation and maintenance costs, and present worth costs. Capital costs and O & M costs will reflect site-specific conditions and will be compiled using the criteria in Section 3.4.5. Present worth costs of competing alternatives with similar environmental, public health, and public welfare benefits will be compared. Present worth costs will allow equivalent cost comparisons of all alternatives as they include the current value of all costs incurred initially and those that will be incurred in the future. Alternatives will be eliminated if they are much more expensive yet offer similar or fewer environmental or public health benefits but no greater reliability than competing alternatives. Alternatives that are more expensive but offer substantially greater non-cost benfits will not be eliminated. After the cost screening process, at least one alternative will remain in each of the five categories listed in Section 3.1.

3.4.7 PLAN RECOMMENDATION

The comparison of each alternative will result in a definitive ranking within each category--technical feasibility, public health risks, environmental protection, institutional concerns, and costs. Based on these rankings, the alternatives will be further ranked to arrive at the recommended remedial alternative. Numerical or weighted value matrix schemes will not be employed. Rather, this ranking will be entirely subjective and reflect the best possible informed judgment. EPA will be consulted during this process to ensure that all relevant factors are considered and the alternative selected is defensible under outside scrutiny.

The description of the recommended plan will include a justification for the alternative selected and a complete definition of the various components of the alternative which will serve as a basis for continued design and ultimate implementation. Included in the description will be:

- A review of what the remedial action will and will not accomplish;
- Special engineering considerations and special studies needed;
- Operation, maintenance, and monitoring requirements;
- Off-site disposal needs and transportation plans;
- Temporary storage requirements;
- Appropriate treatment and disposal technologies;
- Brief descriptions of the environmental and public health problems that may be encountered during implementation; and
- Means of mitigating the associated environmental and public health problems (and their costs).

The recommended plan description will be prepared to meet the overall Feasibility Study requirements. However, a recommended plan may or may not be presented at the discretion of EPA. Guidance on whether or not to provide a recommended plan will be given by EPA prior to completion of the Feasibility Study.

4.0 SCOPE OF WORK

4.1 DEVELOPMENT OF A WORK PLAN

4.1.1 OBJECTIVE

The Work Plan is the principal guidance document for performing Remedial Investigations and Feasibility Studies (RI/FS) at abandoned or uncontrolled waste disposal sites. The Work Plan details the tasks to be performed, the samples to be collected and the analyses and evaluations to be made in order to assess the most feasible source control and remedial action alternative and to arrive at a conceptual design of the control actions for the site.

4.1.2 APPROACH

Fifteen tasks have been formulated to carry out the Remedial Investigation and the Feasibility Study for the South Cavalcade Street Site.

The Remedial Investigation portion of this Work Plan may be amended by mutual agreement of EPA and Koppers. Such amendments shall be in writing and shall have as an effective date the date on which such amendments are signed by EPA.

TASK 0-Develop Work Plan
TASK 1-Compile and Evaluate Background Information
TASK 2-Perform Field Investigations
TASK 3-Perform Endangerment Assessment
TASK 4-Prepare Draft Remedial Investigation Report
TASK 5-Prepare Final Remedial Investigation Report
TASK 6-Develop Remedial Alternatives
TASK 7-Screen Remedial Alternatives
TASK 8-Perform Laboratory Studies/Pilot Testing
TASK 9-Evaluate Remedial Alternatives
TASK 10-Develop Conceptual Design
TASK 11-Prepare Draft Feasibility Study Report
TASK 12-Prepare Final Feasibility Study Report
TASK 13-Perform EPA Designated Activities
TASK 14-Reporting and Management

A major portion of the work necessary to complete Task 0 for the South Cavalcade Street Site, has been completed in the preparation of this Work Plan. Ancillary documents prepared along with the Work Plan include:

- The Interim Site Characterization Report
- Site Plans.

In addition to the Work Plan, reference to these documents while performing the Remedial Investigation and Feasibility Study for the South Cavalcade Street Site is essential. Additional work needed to prepare company and site-specific documents necessary to support the Work Plan and to perform the RI/FS work is detailed below. An example of these documents is provided in the accompanying Project Operations Plan prepared by Camp Dresser & McKee Inc.

4.1.3 SUBTASK 0A - PREPARE HEALTH AND SAFETY PLAN

Objective -- To prepare a site specific health and safety plan, or the equivalent, that shall govern all on-site activities at the South Cavalcade Street Site.

Methodology -- Based on an understanding of level and kinds of contamination at the South Cavalcade Street Site, a site specific health and safety plan should be formulated and submitted to EPA for review and comment prior to commencing any onsite work. At a minimum, this plan shall detail:

- Personnel protective equipment requirements keyed to generalized site localities and activities
- Required safety equipment onsite
- Personnel training requirements
- Medical surveillance program
- Personnel hygiene requirements
- Contingency plan and emergency procedures
- Site personnel activity safety monitoring program
- Decontamination procedures
- Responsibility for health and safety

- Standard operating procedures
- Site description
- Hazard evaluation
- Work limitations
- Emergency information
- Safety of nearby workers and residents

Deliverables -- A health and safety plan; see example provided.

4.1.4 SUBTASK 08 - PREPARE QUALITY ASSURANCE PLANS

Objective -- To prepare site-specific quality assurance and quality control plans that shall govern all work performed onsite and in the office for the RI/FS, including, but not limited to laboratory analyses, work performed by outside contractors, and data validation. The plans shall be developed in accordance with EPA's "Interim Guidelines and Specifications for Preparing Quality Assurance Project Management Plans."

Methodology -- Based on an understanding of the South Cavalcade Street Site, the RI/FS process, and the intent of accomplishing the Remedial Objectives, site-specific quality assurance and quality control plans shall be formulated and submitted to EPA for review and comment. It should be understood, that quality control refers to the procedures implemented to ensure that the data collected are of the highest caliber, whereas quality assurance refers to the set of independent checks and verifications that the quality control procedures have been implemented and are functioning. Quality control includes such things as instrument calibration and maintenance procedures and data recording and gathering format. Quality assurance includes use of duplicates, spikes, and trip blanks, data validation, and other internal audit procedures.

Deliverables -- A quality assurance plan and a quality control paln for the South Cavalcade Street Site; see example provided.

4.1.5 SUBTASK OC - FIELD SAMPLING AND ANALYTICAL PLAN

Objective -- To prepare a site-specific sampling and analyses plan that details all sampling and analytical requirements and procedures for performing the RI/FS at the South Cavalcade Street Site.

Methodology -- A site-specific field sampling and analyses plan shall be formulated and submitted to EPA for review and comment. The field sampling and analytical plan shall be the controlling document for all sampling and analyses performed onsite work at the South Cavalcade Street Site and all laboratory analyses. At a minimum this plan shall detail:

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- The kinds of samples that will be taken; in accordance with this Work Plan
- The locations at which all samples are to be obtained; in accordance with this Work Plan
- Sample numbers
- Sampling techniques and protocols
- Quantities required for specific analyses
- Field handling procedures
- Field tests to be performed, including procedures and the equipment to be used
- Data entry requirements
- Sampling team members and responsibilities
- Sample packaging, marking, and shipping requirements
- The name, address, telephone number, and contact at the analytical laboratory
- Analytical procedures to be used
- Data reporting requirements

Deliverables -- A site-specific field and analytical plan; see example provided.

4.1.6 SUBTASK OD - PREPARE SITE MANAGEMENT PLAN

Objective -- To prepare a site-specific management plan governing all operations at the site, including site access, site security, contingency plans for other than site personnel, and the general coordination of all activities planned for the site.

Methodology -- A site-specific site management plan shall be prepared for the South Cavalcade Street Site, and submitted to EPA for review and comment. The plan shall govern activities on the site, access to the site, disposal or decontamination of field equipment, and site security and shall include contingency plans to deal with non-site personnel.

Deliverables -- A site management plan; see example provided.

The above described plans may be completed as separate, individual plans or as a set of plans encompassed by a single document. Should a single document be prepared, the components that would be the equivalent of the above plans must be clearly evident.

4.2 REMEDIAL INVESTIGATION

4.2.1 OBJECTIVE

The primary objective of the Remedial Investigation is to characterize the South Cavalcade Street Site in terms of the nature and extent of contamination at the site and its threat to human health, welfare and the environment. A second objective of the Remedial Investigation is to obtain the requisite information for performing a Feasibility Study to ascertain the most feasible methods to remediate the threats to public heatlh and safety and the environment, in accordance with the National Contingency Plan. The background of the site--its location and history of use and the nature and extent of the problem--has been summarized in Section 2 of this Work Plan and are described more fully in the Interim Site Characterization Report for the South Cavalcade Street Site. The accompanying Site Plans provide additional relevant information with respect to the location of current

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facilities on the site, facilities related to the wood treating and preserving activities that formerly occurred on the site, and proposed sampling localities. All tasks of the Remedial Investigation are to be performed as described below and in accordance with Koppers' Project Operations Plan for the South Cavalcade Street Site or an equivalent set of plans.

4.2.2 TASK 1 - COLLECTION OF ADDITIONAL BACKGROUND INFORMATION

SUBTASK 1A - REVIEW KOPPERS COMPANY FILES AND INTERVIEW FORMER EMPLOYEES

Objective -- To obtain all possible information relating to past operations by Koppers Company and its predecessor National Creosote and Lumber Company at the South Cavalcade Street Site. This information might include further documentation of the processes that were used, waste disposal practices, spills that were used, and the locations of important facilities. Historic site plans and maps would be particularly useful.

Methodology - Careful review of Koppers Company files and archival data; interviews with current and past employees of Koppers Company and it predecessor, National Creosote and Lumber Company, who might have information pertinent to the facilities and the operations at the South Cavalcade Street Site.

Deliverables -- Addenda to the previously prepared Site Plans and Interim Site Characterization Report.

SUBTASK 1B - AERIAL PHOTO EVALUATION

Objective -- To evaluate historic aerial photos to document the kinds and locations of wood treating and wood preservation operations that have occurred on the South Cavalcade Street Site.

Methodology -- Review and interpret available aerial photography for the South Cavalcade Street Site. A preliminary listing of sources, vintages, scales, is contained in Table 4-1. Interpretation using stereo pairs may

TABLE 4-1

HISTORICAL AERIAL PHOTOGRAPH COVERAGE FOR
SOUTH CAVALCADE SITE, HARRIS COUNTY, TEXAS

Comment	Year	Agency	Scale	Photo No.	Cost	Total
B & W	1930	Tobin	1" = 1500'		$50 first photo $25 @ add. photo per roll	
B & W	1935	Houston Pub. Lib.	1:24,000			
B & W	1938	Nat'l. Archives (ASCS)	1:20,000	BQY 5, 4, 3, 2, 1	$3.00 ea.	$15.00
Unavailable	1938	Texas Petroleum Information Ctr.	1:20,000			
B & W	1944	ASCS	1:20,000	BQY-4C 144, 143, 142	3.00 ea.	9.00
B & W	1945	Houston Pub. Lib.	1:18,000			
B & W	1952	Houston Pub. Lib.	1:20,000			
B & W	1953	ASCS	1:20,000	BQY-13M 86, 87, 88	3.00 ea.	9.00
B & W	1955	Houston Pub. Lib.	1:20,000			
B & W	1956	Tobin	1"=6300'			
B & W	1956	Texas Petroleum Information Ctr.	1:2500			
B & W	1957	ASCS	1:20,000	BQY-4T 135, 136, 137	3.00 ea.	9.00
B & W.	1964	ASCS	1:20,000	BQY-3FF 144, 145, 146, 147	3.00 ea.	12.00
B & W	1965	Houston Pub. Lib.	1:12,000			
B & W	1966	USGS	1:21,314			
B & W	1971	Adams Aerial Survey	1:36,000		5.00 ea.	
B & W	1972	Adams Aerial Survey	1:36,000		15.00 ea.	
B & W	1973	ASCS	1:40,000	A40-48201-173, 199, 200	15.00 ea. 3.00 ea.	9.00
B & W	1974	Adams Aerial Survey	1:36,000		15.00	
B & W	1975	Houston Pub. Lib.	1:12,000			
B & W	1975	Tex. Highway Dept.	1:12,000			

*More recent photos available, but probably unimportant.

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provide the best approximation of the facilities and plant layout at the time the photographs were taken. Composited enlargements may then be used to generate a series of overlays that include, among other things, delineation of areas where contaminated soils are potentially present, either because staining is visible on the photographs or because the facilities and the structures observed are those where, through use, contamination might occur.

Deliverables -- Addenda to the Site Plans and the Interim Site Characterization Report.

SUBTASK 1C - SITE SURVEY

Objective -- To produce a survey of the South Cavalcade Street Site that accurately delineates the current topography, using a one-foot contour interval, site boundaries, and existing features; buildings, paved areas, storage tanks, rail lines, loading docks, waste piles, observation wells, etc. The occurrence of above and below ground utilities on and adjacent to the site should also be determined and plotted on the survey. The topographic survey may ultimately become the base map on which all areal information obtained in further Remedial Investigation work is plotted.

Methodology -- The site survey may be produced using a combination of aerial photography, ground-surveying, and research of the local utility company files.

Deliverables -- A site survey, with topography, that can serve as the base map for plotting all areal information obtained in the future, and overlays depicting current facilities on the site and utilities on and adjacent to the site. These deliverables shall become addenda to the Interim Report on Existing Information and the Site Plans. The scale of the site survey shall be 1" = 100'.

SUBTASK 1D - WELL INVENTORY

Objective -- To document the occurrence of all current and historical municipal, industrial and domestic water wells, waste disposal wells, or oil or gas wells within two miles of the site.

Methodology -- Review and compile data from the records and publications of the Texas Department of Water Resources and the Texas Railroad Commission. Field verify the presence of these wells. In addition, inventory and field verify the presence of any wells for which there is no record with the public agencies that might occur within the equivalent of three city blocks of the current site boundary, or the limits of the contaminant plume, whichever is greater. Interviews with current and former employees of major companies and home owners in the area might be necessary.

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Deliverables -- A detailed documentation, using maps, copies of public documents, and necessary narrative description, of the wells that occur in the vicinity of the site. Those for which there is a public record shall be field verified as to location, use, and condition within two miles of the site; those identified within the equivalent of three city blocks of the current site boundary, or the contaminant plume, may include those for which there is no public record.

4.2.3 TASK 2 - PERFORM FIELD INVESTIGATIONS

SUBTASK 2A - SURFACE WATER CHARACTERIZATION

Objective -- To obtain information on the quality of surface water runoff leaving the site, in puddles on or adjacent to the site, and in drainage ditches on and or adjacent to the site. Although past sampling at the South Cavalcade Street site suggests that contamination of surface water is not a problem, this should be verified with additional sampling. The surface water samples shall be analyzed for contaminants that might be incorporated into the water from past wood treating and preserving operations.

Methodology -- Runoff shall be sampled at least twice during the field program. In each of the sampling rounds, two samples shall be taken during the first flush, that is when runoff begins. One of the samples taken during the first flush should be a sample only of the water, that is without sediment or surface film. The other sample should include the surface film. If no surface film exists at the time of sampling, this sample may be omitted. All sampling equipment shall be properly cleaned prior to use or reuse.

Sampling Locations -- Tentative surface water sampling locations are shown in Figure 4-1 and described below.

1) In the drainage ditch and catchment basins north and east of Meridian Fast Motor Freight Lines; one locality

2) In the drainage ditch on the east side of the site adjacent to the Houston Belt and Terminal railroad lines; two localities.

3) In the drainage ditch adjacent to the Missouri Pacific Railroad lines at the southwest corner of the Site where the ditch passes beneath Collingsworth Street.

The final selection of the locations for surface water sampling shall be made with the review and guidance of EPA after subtask 1C - Site Survey has been completed.

Analyses -- Analyses of first round surface water samples shall be for the following:

<u>Field Analyses</u>

	Method No.
• pH	
• Temperature	150.1
• Conductivity	170.1
• Dissolved oxygen	120.1
• Flow	360.1/360.2

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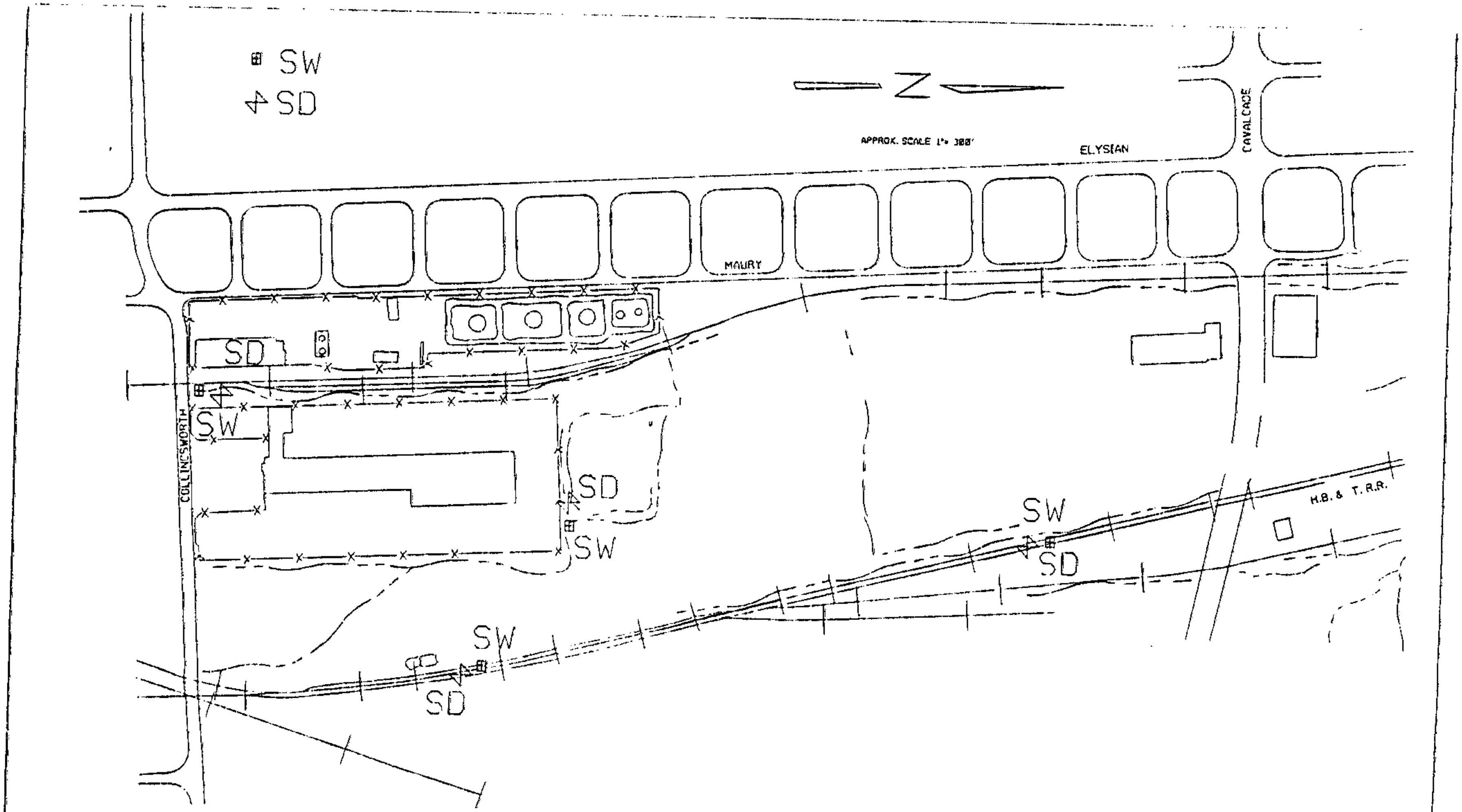

PROPOSED SEDIMENT AND
SURFACE WATER SAMPLING SITES

CAMP DRESSER & McKEE INC.

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Laboratory analyses[a]	Method No.
1) Volatile Organics; Library search[b]	624
2) Acids Fraction; Library search[c]	625
3) Bases/Neutrals; Library search[c]	625
4) Priority Pollutant Metals	200.2
5) Cyanide	335
6) Iron	236

Analyses of the samples containing the surface film shall be for Total Petroleum Hydrocarbons (EPA Method No. 418.1)[a] only.

[a]All laboratory analyses are to be performed by a laboratory experienced and equipped to handle high hazard materials.
[b]The library search is to identify up to 10 compounds with concentrations greater than 10 percent of internal standards.
[c]The library search is to identify up to 20 compounds from the acids/bases/neutrals fractions with concentrations in excess of 10 percent of internal standards.

For the second round of surface water samples, the field analyses will be conducted as noted above and the following modifications are permitted for the laboratory water sample analyses:

1) Volatile Organics; Library search[b] -- Select one-third of samples
2) Iron -- Consult with EPA for approval to drop this analysis

Deliverables --

1) Results from field analyses
2) Results of laboratory analyses
3) Completed chain of custody forms
4) Memorandum describing field activities and documenting sample collection and sample techniques.

Contingency -- If the first round does not indicate contamination of the surface runoff from the site, the number and locations of the second round samples and the analyses performed shall be the same as the first round. If contamination of the surface water is detected in either round, EPA shall be consulted to devise a program to detect the source(s) and significance of the contamination. In addition, should sampling and analyses of the shallow groundwater beneath and adjacent to the site reveal that the movement of contaminants to nearby drainage ditches and bayous is occurring or is likely to occur, additional surface water samples in those drainage ditches and bayous will be required. In all cases, review and guidance by EPA shall determine whether additional sampling shall be required.

SUBTASK 2B - SURFACE SEDIMENT CHARACTERIZATION

Objective -- To obtain information about the surface sediments that occur in drainage courses and other low lying areas on and adjacent to the South Cavalcade Street Site. Although past sampling suggests that contamination of the surface sediments in the drainage courses on and adjacent to the site is not a severe problem, this should be verified with additional sampling.

Methodology -- A single tube, shallow water sediment sampler may be used to collect the surface sediment samples. Samples should be collected during the surface water sampling, when the "first flush" sampling water samples are collected. Additional samples may be collected in other low-lying areas or drainage courses where no runoff is encountered during the sampling of the surface water. All sampling equipment shall be properly cleaned prior to use or reuse.

Sampling Locations -- Tentative surface sediment sampling locations are shown in Figure 4-1 and described below.

1) In the drainage ditch and catchment basins north and east of Meridian Fast Motor Freight Lines; one sample.

2) In the drainage ditch on the east side of the site adjacent to the Houston Belt and Terminal railroad lines; two sampling localities.

3) In the drainage ditch adjacent to the Missouri Pacific Railroad lines at the southwest corner of the site.

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Analyses -- Analyses of the surface sediment samples shall be for the following:

Laboratory Analyses[a]	Method No.
1) Volatile Organics; Library search[b]	8240
2) Acids; Library search[c]	8250
3) Bases/Neutrals; Library search[c]	8250
4) Priority Pollutant Metals + Iron[d]	6010
5) Cyanide	9010
6) Arsenic	7061
7) Size Analysis	ASTM D-0422

Complete analyses, as described above, shall be performed on the first round of sediment samples. For the second round of sediment samples, the following modification is permitted for the sediment sample analyses:

- o Volatile Organics; Library search[b] -- Select one-third of samples

[a]All laboratory analyses are to be performed by a laboratory experienced and equipped to handle high hazard materials.
[b]The library search is to identify up to 10 compounds with concentrations greater than 10 percent of internal standards.
[c]The library search is to identify up to 20 compounds from the acids/bases/neutrals fractions with concentrations greater than 10 percent of internal standards.
[d]Iron may be deleted on the second round of sediment sampling with EPA approval.

Deliverables --

1) Results from analytical laboratory analysis
2) Completed chain of custody forms
3) Memorandum describing field activities and documenting sample collection and sampling techniques

Contingency -- Should extensive or severe levels of contamination be found in the surface sediments on or adjacent to the site, or should the results of the two rounds of sampling of the surface sediments be in conflict,

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additional sampling shall be required to resolve the contradiction and, if necessary, to ascertain the sources of the contamination. In addition, should sampling and analyses of the shallow groundwater beneath and adjacent to the site reveal that movement of contaminants to nearby drainage ditches and bayous, then the sampling of surface sediments in those drainage ditches and bayous shall be required. Furthermore, if the analytical results indicate the presence of pentachlorophenol at concentrations greater than 1000 ppm, further field investigations should cease immediately, and the scope of work reevaluated and revised. In all cases, review and guidance by EPA shall determine whether additional sampling and analyses will be required.

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SUBTASK 2C - GEOPHYSICAL SURVEYING

Objective -- To survey the South Cavalcade Street Site using geophysical tools; surface resistivity, electromagnetics, ground penetrating radar, or some combination of the three. The purpose of the geophysical investigation is:

1) To employ a rapid, noninvasive investigative technique as a means of supplementing information obtained from bore holes.

2) To provide a means of correlating and filling information between existing bore holes.

3) To provide a means of better defining the configuration and attitude of important stratigraphic units beneath the site and in particular to identify subsurface irregularities in the shallow aquifer.

4) To provide a means of identifying concentrated accumulations of contaminants from the former wood preserving operations on the site, or any current operations on the site.

5) To provide information relative to altering or modifying the subsurface sampling program and the shallow well installation program described below.

Methodology - Because of the uncertainty as to whether geophysical techniques (i.e. resistivity, electromagnetics, and ground penatrating radar) will produce usable information at the South Cavalcade Street Site, the three techniques should be tested for utility and effectiveness. Based on current information, the test area should be relatively free of contaminants from the wood preserving operations that occurred there and at some distance from existing buildings, fences, power lines and the like. It is imperative to determine at the outset which, if any, of the geophysical tools can be employed.

Resistivity soundings should be performed first followed by testing of the electromagnetics and ground penetrating radar to arrive at the optimum combination that provides the best resolution; continuous profiling is desired. Should any, or some combination, of the geophysical techniques prove effective, a plan to investigate the rest of the site should be developed and submitted to EPA for review. In general, the initial profiles should be widely spaced, with infilling traverses established based on the results obtained, the ability to traverse the site with the particular geophysical tool being used, and other factors, as identified in the field. Onsite data processing capability will facilitate obtaining maximum benefit from the geophysical tools.

Sampling Localities -- To be determined in the field based on the criteria established in "Methodology."

Deliverables --

1) Contour and isopach maps and stratigraphic profiles of the soils materials of the shallow aquifer and the overlying materials.
2) Memorandum confirming or recommending alterations and modifications of the subsurface boring and well installation programs described below.

Contingency -- The geophysical investigation program described above is highly dependent on the success of the tests and the care with which the program is carried out. Addition of traverse lines may be desirable to better define subsurface and contaminant conditions at the site. The review and guidance of EPA with respect to the test results and the data gathered subsequently shall determine whether additional geophysical work should be carried out or whether further work may be eliminated.

SUBTASK 2D - SUBSURFACE SOIL SAMPLING

Objective -- To characterize the areal extent and depth of contamination in the subsurface soils on the South Cavalcade Street Site and the physical properties of the soil materials. Although the intent is to adequately characterize the entire site, emphasis in the subsurface sampling should be on those areas that are most likely to be contaminated.

Methodology -- Localities specified below for subsurface soils investigation should be investigated first with a portable power auger to ascertain the limits of soils contamination and to guide the placement of deeper subsurface borings. Materials brought up from depth with the power auger shall be visually described and tested for zinc, chromium, copper, and arsenic with a portable X-ray fluorescence machine or the equivalent, and for total hydrocarbon content or equivalent using both a flame ionization detector such as an OVA 128, or the equivalent, and an HNu with a lamp having the appropriate ionization potential. On the average, one sample from each power auger boring shall be tested for the above metals and total hydrocarbon content. All downhole equipment shall be properly cleaned between use. All materials removed from the holes shall be collected, containerized, and stored in compliance with RCRA regulations (no permit required) for propoer disposal. The holes will be grouted back to the surface with a non-shrink bentonite-cement mix.

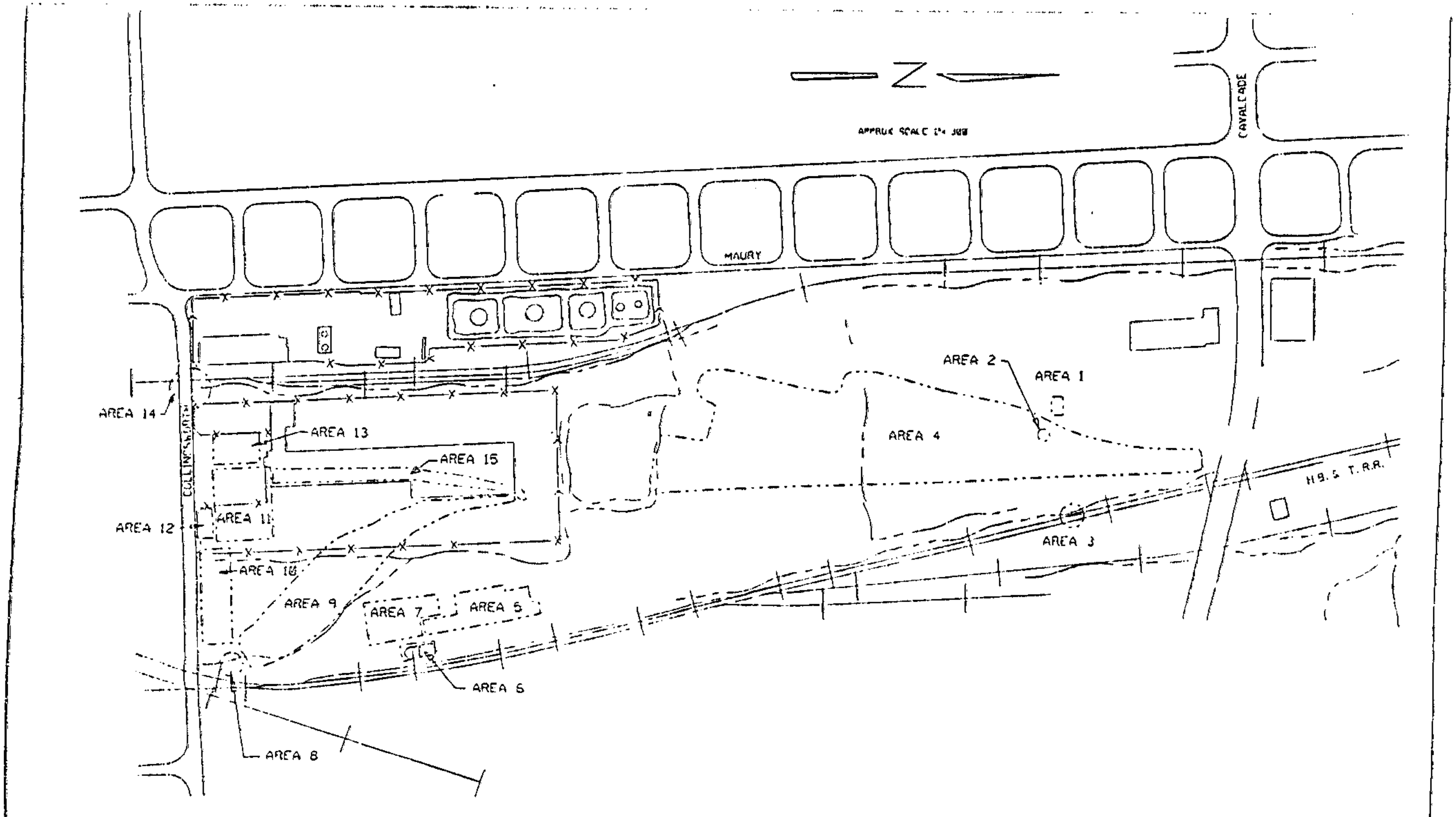
Continuous borehole samples shall be obtained using a combination of dry augering and either thin wall (Shelby tube) or split spoon samplers. At each sample locality, the sampler should be advanced either by pressing the sampler into the soil (thin wall) or by driving it downward (split spoon).

Upon removal from the ground, the samples should be checked for the emis-
sion of volatile organics. After extrusion or opening of the sample and a
recheck for volatile emissions, the outer one-half inch and the disturbed
ends of the sample should be trimmed, and the sample described, sectioned,
and bottled for further analyses or storage, as appropriate. All non-
analysed samples shall be archived through the Remedial Design Phase. All
downhole sampling equipment shall be cleaned prior to reuse; details of the
sampling procedure are contained in the example Project Operations Plan.
The boreholes are to be advanced to a minimum depth of five below the base
of the shallow aquifer or until there is no overt contamination detected
either visually, with the olfactory senses, or with field testing equip-
ment. Approximately one half of the boreholes at any one sampling locality
should be advanced to a minimum depth of 50 feet. All non-sample materials
removed from the boreholes shall be collected, containerized, and stored in
compliance with RCRA regulations (no permit required) for proper disposal.
The boreholes shall be grouted back to the surface with non-shrink
bentonite-cement mix as the augers are withdrawn from the hole.

Sampling localities -- Based on the examination of historic aerial photo-
graphs and previous data collected for the South Cavalcade Street Site,
sampling localities have been primarily defined (Figure 4-2). These may be
modified based on information obtained from Subtask 2C and where the
presence of permanent structures impedes boring.

1) Area 1 -- In the vicinity of a lagoon identified in the northern part of the site. One borehole shall be advanced in the center of the suspected lagoon, a minimum of four boreholes shall be advanced around the indicated margins of the lagoon to better confirm its dimension and to ascertain the lateral and vertical extent of contamination.

2) Area 2 -- In the vicinity of a circular area to the southeast of the suspected lagoon, where some non-soil material is visible and little plant life occurs. One borehole shall be advanced in the center of the circular area a minimum of three boreholes shall be



PROPOSED SUBSURFACE BORING AREAS

CAMP DRESSER & McKEE INC.

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advanced outside of the circular area to better define the lateral and vertical extent of any contamination associated with this area.

3) Area 3 -- In the vicinity of CAV-OW-14, a shallow observation well on the east side of the tract in which overt contamination was noted during installation. A minimum of three boring shall be advanced in this area to ascertain the nature and the extent of the contamination. Some borings may need to be advanced outside of the site boundary along the H. B. & T. Railroad tracks.

4) Area 4 -- In an area in which treated lumber was commonly stored. A minimum of six borings shall be advanced in this area to ascertain the nature and extent of contamination.

5) Area 5 -- Beneath and around an old concrete loading dock that handled products from the tar refining plant. A minimum of five boreholes shall be advanced to ascertain whether spillage or leakage associated with the loading dock has contaminated the soils in the area.

6) Area 6 -- In the vicinity of two former spray ponds that were associated with the tar refining plant. Old plant drawings suggest that the ponds were constructed with concrete and measured 40' x 50' x 4.5' and 36.7' x 53.5' x 4.5'. Examination of a 1944 aerial photography, however, suggests that the pond to the south was of earthen construction at least at that time. A minimum of six boreholes shall be advanced to ascertain whether leakage associated with the former ponds has contaminated the underlying soils and to define the extent of potential contamination. Two of the boreholes shall be advanced within the area that the ponds once occupied; the remaining boreholes should be outside the former pond area.

7) Area 7 -- In the vicinity of the tanks and the main portion of the tar refinary on the east side of the site. At least one boring shall be advanced where each of the tanks (5), once stood or where overt contamination might be detected immediately outside of the

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footprints of the tanks, five additional borings should be advanced within and immediately adjacent to the footprint of the former tar processing plant.

8) Area 8 -- In the the vicinity of the southeast corner of the site. No analyses were performed on samples previously collected from this area, thus, further sampling is necessary. A minimum of two boreholes shall be advanced in this area, one of which may be off-site.

9) Area 9 -- In an area in which treated lumber was apparently commonly stored. A minimum of six borings shall be advanced in the area to determine the nature and exent of contamination.

10) Area 10 -- In the vicinity of the four large storage tanks that once occupied this area. One borehole shall be advanced where each of the tanks once stood or where overt contamination might be detected immediately outside of the tank footprint. Up to eight additional borings shall be advanced to ascertain the lateral and vertical extent of contamination that might have emanated from the tanks.

11) Area 11 -- In the vicinity of the old retort and the storange tanks that were once located in the southern part of the site. A rectangular sampling area that encompasses the locations of these former facilities should be established. Four borings shall be advanced at the corners of the sampling area; two should be advanced within the rectangular area.

12) Area 12 -- In the vicinity of an old cooling pond identified on a 1951 drawing of the wood treating and preserving facility. A minimum of three boreholes shall be advanced on the east, west, and south sides of the former pond to discern signs of any contamination that might be related to the former cooling pond and to determine the lateral and vertical extent of contamination.

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13) Area 13 -- Within and immediately adjacent to a former structure labeled on the 1951 plan of the facility as "Treated Lumber Shed, Earthen Floor." A minimum of four borings shall be advanced within an immediately adjacent to the footprint of this structure, but outside of any existing structures on the site, to discern signs of contamination and, if any, to determine its areal and vertical extent.

14) Area 14 -- In the vicinity of the southwest corner of the site where overt contamination has been detected at the ground surface and in the groundwater in observation well CAV-OW-10. A minimum of four boreholes shall be excavated to determine the nature and the lateral and vertical extent of contamination detected in this area; two of these borings may be off-site.

15) Area 15 -- Along the drip tracks associated with the original creosoting plant and including the area in which treated lumber appears to have been stored. A minimum of four boreholes shall be advanced to ascertain the extent of contamination, if any, one of the borings should be outside of the indicated area of contamination.

16) In addition, a minimum of ten boreholes shall be advanced in the remaining areas of the site to ascertain whether additional areas of the site might be contaminated. In general, the boreholes should be advanced to allow relatively even coverage of the site. Specific localities should be selected, however, in response to:

-- Information obtained from the review of Koppers Company files and interviews with current and former employees, described in Subtask 1A.
-- Further information obtained from the interpretation of historic aerial photographs, described in Subtask 1B;
-- Indications of soil contamination obtained during the geophysical investigation of the site, described in Subtask 2C;
-- Evidence of overt contamination found in performing surface water, sediment and the subsurface sampling; or
-- Any other indications of contamination at the site.

Analyses -- All samples obtained shall be screened visually, with the olfactory senses, and the OVA and HNu field instruments as described above.

In addition, after the sample has been placed in a bottle for storage or further testing, a head space analysis shall be performed in the field under carefully controlled conditions (temperature, time). Selected samples shall be further screened by surrogate analysis for zinc, copper, lead, chromium, and arsenic using a portable X-ray fluorescence machine, or the equivalent, and for total petroleum hydrocarbons using a modified EPA method 3540/418.1 (infrared spectrophotometer), or equivalent. At a minimum, this shall include samples from each distinct soils material encountered in the borehole; approximately four samples per boring on the average. From the samples subjected to the surrogate analysis, thirty samples or 15 percent (whichever is greater) shall also be analyzed for the following[a]: 001324

1) Acid and Base/Neutral Fraction Mix (Capillary GC/MS; Method No. 8270); Library Search[b]

2) Metals; iron, zinc, copper, chromium, lead, arsenic (Method No. 6010)

3) Cyanide, (Method No. 9010)

[a]All laboratory analyses are to be performed by a laboratory experienced and equipped to handle high hazard materials.
[b]The library search is to identify up to 20 compounds with concentrations greater than 10 percent of internal standards.

These samples shall be fully representative of the contaminated and uncontaminated soils encountered on the site.

Finally, should highly contaminated soils (containing relatively pure product) be encountered in Area 1 or elsewhere on the site, up to 3 samples per area shall be subjected to laboratory analysis of the following parameters:

Laboratory Analyses[a]	Method No.
1) Volatile Organics; Library search[b]	8240
2) Acid Fraction; Library search[c]	8250
3) Bases/Neutrals; Library search[c]	8250
4) Priority Pollutant Metals + Iron	6010
5) Cyanide	9010
6) Arsenic	7061

[a]All laboratory analyses are to be performed by a laboratory experienced and equipped to handle high hazard materials.
[b]The library search is to identify up to 10 compounds with concentrations greater than 10 percent of internal standards.
[c]The library search to identify up to 20 compounds from the acids/bases/neutrals fractions with concentrations greater than 10 percent of internal standards.

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In addition to chemical analyses of samples obtained in the surface investigation, a selected number of samples that have no apparent contamination should be tested to ascertain their physical parameters in sufficient detail for engineering design purposes. Accuracy of visual, olfactory, and field tests should be determined prior to performing the geotechnical tests; thus samples for geotechnical testing should be collected and preserved in such a manner as to assure the validity of the test results. Geotechnical tests that should be performed include, but are not limited to:

Geotechnical Analyses

-- Natural moisture content
-- Unit dry weight
-- Atterberg limits
-- Passing 200 mesh sieve
-- Unconfined compressive strength (cohesive soils)
-- Vertical permeability (clays or silty clays)

Deliverables --

1) Borehole Logs (Unified Soil Classification, at a minimum, but including blow counts, and static water levels in the boreholes)
2) Results of OVA, HNu, head space readings
3) Results of surrogate analyses
4) Results of laboratory analyses
5) Results of geotehnical analyses
6) Copies of the field notes of the supervising geologist or engineer

Contingency -- Should extensive or severe contamination of the subsurface soils on the site be indicated, but not adequately characterized by the above described subsurface investigation program, additional soil analyses, boreholes or trenches may be required. The required additional borings or trenches may be onsite or off-site. If the results of these analyses indicate the presence of pentachlorophenol at concentrations greater than 1000 ppm, further field investigations should cease immediately and the scope of work reevaluated and revised. In all cases, review and guidance by EPA shall determine whether additional laboratory analyses, boreholes, or trenches shall be required.

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SUBTASK 2E - SHALLOW GROUNDWATER INVESTIGATION

Objective -- To obtain information on the hydrology and quality of shallow groundwater beneath and adjacent to the site and to determine if significant levels of contaminants are being transported off-site in the shallow groundwater. An auxiliary purpose of the shallow groundwater is to obtain additional information on the subsurface soils on the site. The shallow aquifer typically occurs at a depth of 10 to 20 feet below the ground surface.

Methodology --

A. Installation of Observation Wells: The observation wells shall be constructed, completed, and developed according to the detailed procedures contained in the approved Field Sampling and Analytical Plan. Briefly, the general installation procedure and characteristics of the observation well should be as follows:

Observation wells in the shallow aquifer shall be drilled using a combination of split spoon or Shelby tube sampling and dry hollow-stem augering technique. The depth of the wells shall be governed by the stratigraphy beneath the site, established by the subsurface boring program. Continuous soil samples shall be taken to a depth of two feet below the base of the shallow aquifer, described, tested in the field (including head space analyses), and preserved as described in Subtask 2D for the subsurface investigation. All downhole equipment shall be steam-cleaned prior to commencing drilling at each hole; all sampling equipment shall be properly cleaned prior to reuse. All nonsample materials removed from the well shall be collected, containerized, and stored in compliance with RCRA regulations (no permit required) for proper disposal.

The observation wells may be either 2 inch or 1-1/2 inch, flush-joint, Schedule 40 PVC, with manufactured PVC screens. All joints must be screw threaded or riveted; no solvent welded joints are permitted. The well screens shall have 0.010 inch openings and be of sufficient length to screen the entire thickness of the shallow aquifer and two feet above the indicated water table. The well screen and casing shall be thoroughly cleaned prior to installation.

The well screen and casing shall be installed through the hollow stem of the auger. The entire length of the well screen to two feet above the top of the well screen (if possible) shall be packed with an appropriate sized material to facilitate hydraulic communication of the well with the adjacent aquifer and to minimize clogging. The pack material should be installed as the augers are withdrawn from the well bore. Use of 1-1/2 inch PVC rather than 2 inch PVC facilitates placement of pack material, while minimizing clogging or bridging. Approximately two feet of pure, high sodium bentonite shall be placed above the pack material, and the remainder of the well bore grouted back to the surface with a non-shrink bentonite-cement grout. Each well shall be adequately protected with a lockable steel casing, concrete pad, and cement-filled steel barriers as described in the example Project Operations Plan. The proper identification code of the observation well shall be permanently affixed to the protective casing.

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The observation wells shall be developed to as sediment-free as possible condition using air lifting or other appropriate techniques. Development shall proceed for a minimum of 30 minutes or 5 casing volumes, whichever takes longer. A sediment-free condition shall then be defined as less than 0.01 ml of sand collected in a 1000 ml Imhoff cone when sampled 1 to 2 minutes after start of pumping or a total maximum development time of 2 hours, excluding any non-pumping or developing intervals longer than 15 minutes.

All water produced during development of the wells shall be collected, containerized, and stored in accordance with RCRA regulations (no permit needed) for proper disposal. The location of the wells shall be surveyed to the nearest 0.01 foot. The ground surface at the well and casing stick up shall be surveyed to the nearst 0.1 foot, and a permanent mark affixed to the casing for subsequent consistent measurement of water levels.

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B. Water Level Measurements: Measurement of water levels in the fourteen new observation wells and the eight existing observation wells shall be made no sooner than one week nor more than one month after installation of the new wells. Thereafter, water levels in all observation wells shall be measured at least quarterly for a period of one year and whenever samples are taken for water quality analyses. In addition, water levels should be measured on a frequent basis (daily to weekly) following at least one period of wetter than normal weather to detect whether individual recharge events directly influence water levels in the shallow aquifer. To the extent possible, whenever water level measurements are made, all measurement should be completed on the same day, the total depth of the well should be measured each time the water levels are measured. All downhole measuring equipment should be properly cleaned prior to reuse.

C. Groundwater Sampling: The groundwater in all 14 newly installed onsite and off-site observation wells and 8 existing onsite observation wells shall be sampled for chemical analyses approximately four weeks after the new wells have been installed and again approximately three months later. Three to ten casing volumes shall be purged from each well, using a bailer, peristaltic pump, or other appropriate means, prior to removing the sample of record. Water produced during the purging operation shall be collected, containerized, and stored in accordance with RCRA (no permit required) for proper disposal. Should an observation well fail to yield the required quality of water during purging, the well should be bailed or pumped dry and the sample obtained as soon as there is sufficient water in the well for the required sample volume. Details of the sampling procedure are described in the example Project Operations Plan. Two rounds of sampling shall be deemed sufficient, should the analytical results be consistent. If inconsistencies develop, a third round of sampling shall be required.

D. Aquifer Properties: Aquifer properties in the shallow aquifer shall be determined using selected observation wells, which, based on one or more rounds of water quality analyses, appear to be relatively free of contam-ination. A modified slug or falling-head permeable test is envisioned, but other suitable testing procedures may be substituted, provided that they do not lead to significant discharges from the wells. Any water removed from the wells shall be collected, containerized, and stored in accordance with RCRA (no permit required) for proper disposal. Aquifer tests should be performed at approximately five wells.

Sampling Localities -- 14 localities onsite and off-site have been prelimi-narily selected for installation of new observation wells into the shallow aquifer (Figure 4-3). The localities were selected based on available hydrologic and water quality data for the shallow aquifer. The wells are intended to better define the configuration of the water table in the shallow aquifer and to document extent of groundwater contamination beneath the South Cavalcade Street Site and its migration from the site. Alternate localities may be selected based on:

-- Information obtained from review of Koppers Company files and interviews with current and former employees, described in Subtask 1A;
-- Further information obtained from the interpretation of historic aerial photographs, described in Subtask 1B;
-- The geophysical investigation, described in Subtask 2C;
-- Other indications of contamination at the site or conflicts with the localities selected.

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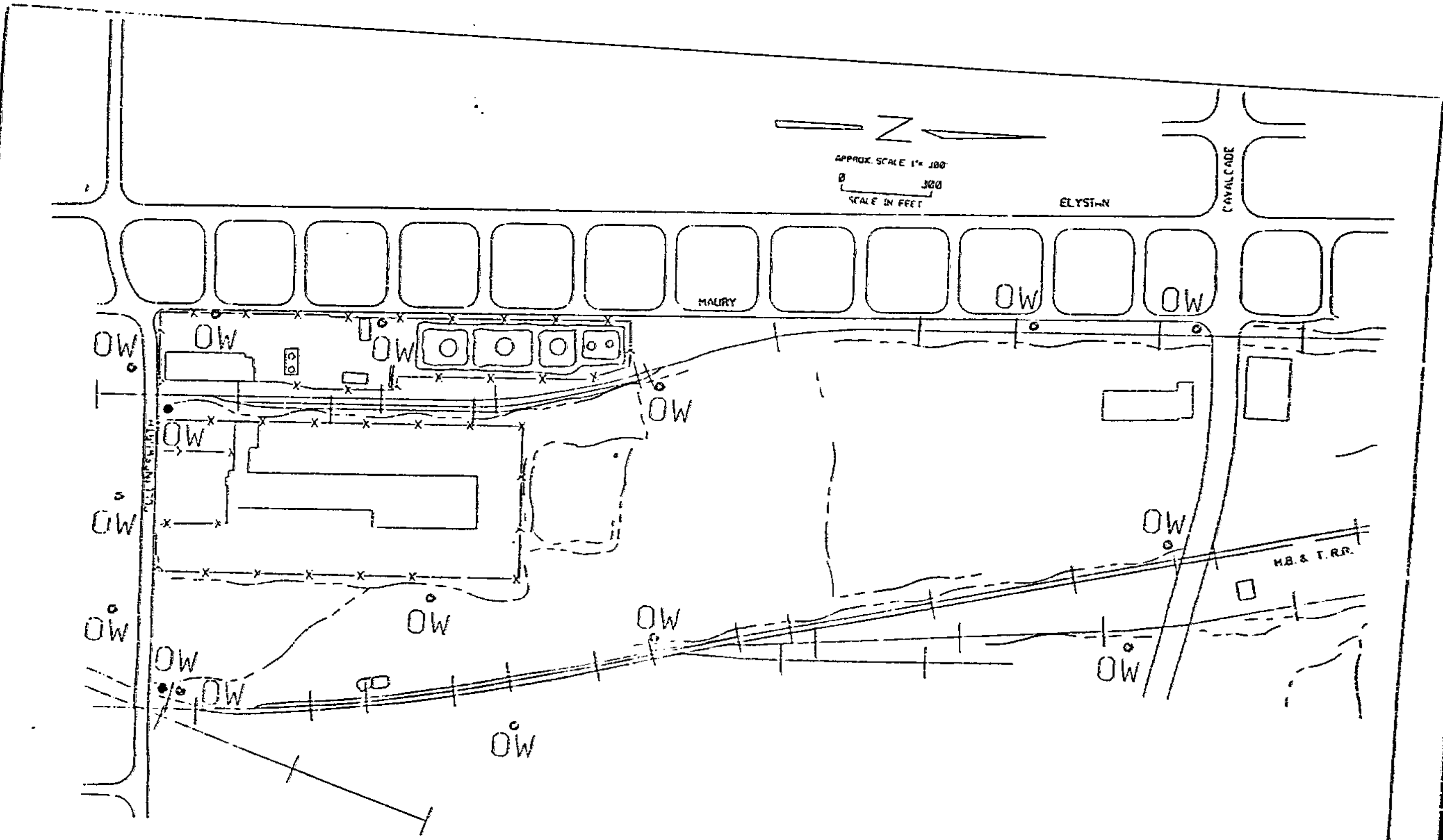

PROPOSED OBSERVATION WELL LOCATIONS

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Analyses -- Analyses of the first round of shallow groundwater samples from the fourteen newly installed wells and the eight existing onsite wells shall be for the following:

Field Analyses

		Method No.
1)	pH	150.1
2)	Conductivity	120.1
3)	Temperature	170.1

Laboratory Analyses[a]

		Method No.
1)	Volatile Organics; Library search[b]	624
2)	Acids Fraction; Library search[c]	625
3)	Bases/Neutrals; Library search[c]	625
4)	Priority Pollutant Metals	200.2
5)	Cyanide	335
6)	Iron	236
7)	Nitrate	300
8)	Pesticides & PCB's	608

[a]All laboratory analyses are to be performed by a laboratory experienced and equipped to handle high hazard materials.
[b]The library search is to identify up to 10 compounds with concentrations greater than 10 percent of internal standards.
[c]The library search is to identify up to 20 compounds from the acids/bases/neutrals fractions with concentrations greater than 10 percent of internal standards.

The analysis of the 22 shallow groundwater samples collected during the second round may be modified as follows:

1) Volatile Organics; Library search[b] - select one-third of samples collected
2) Acids Fraction; Library search[e]
3) Bases/Neutrals; Library search[e]
4) Priority Pollutant Metals - select one-third of samples collected
5) Copper, chrome, zinc and arsenic remaining two-thirds of samples collected

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6) Iron - consult with EPA

7) Pesticides and PCB's - select one-third of samples collected

[b]The library search is to identify up to 10 compounds with concentrations greater than 10 percent of the internal standards

[d]The library search to identify up to 10 compounds with concentrations greater than 10 percent of the internal standards can be limited to a select one-third of the samples

[e]The library search to identify up to 20 compounds from the acids/bases/neutrals fractions with concentrations greater than 10 percent of the internal standards can be limited to a select one-third of the samples.

If further sampling is required after two rounds due to inconsistencies between the first two rounds, then selected parameters may be eliminated from the analysis with EPA approval.

Deliverables --

1) Well logs and completion records for all newly installed observation wells
2) Documentation of the volume and disposition of all water and residual soils materials removed from the wells
3) Copies of the field notebook of the supervising geologist or engineer
4) All water level measurements and interpretations of the configuration of the water table in the shallow aquifer
5) Field analysis results
6) Analytical laboratory results
7) Copies of the chain of custody forms
8) Raw data and results of all aquifer tests

Contingency -- Should extensive or severe levels of contamination be found in the shallow aquifer beneath the site, leaving or having the potential to leave the confines of the site, or in areas adjacent to the site, installation of additional observation wells shall be required to ascertain the extent, concentrations, and rate of migration of the contaminants. Monitoring beyond the one year specified above may also be required. In all cases, the review and guidance of EPA shall determine whether additional wells, or additional groundwater samples, or analysis for additional quality parameters are necessary.

SUBTASK 2E - DEEPER GROUNDWATER INVESTIGATION

Objective -- To determine whether contaminants related to past and current activities on the South Cavalcade Street Site have affected the quality of groundwater in the deeper aquifer, considered here to be the aquifer occurring approximately 200 feet below the ground surface, and, if necessary, to investigate the hydrology of the deeper aquifer system.

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Methodology --

A. Installation of Observation Wells: Observation wells installed into the deeper aquifer should be constructed and completed as described in the approved Field Sampling and Analytical Plan. To minimize the possibility of inadvertently contaminating the deeper aquifer when the well is installed, a telescoping procedure shall be employed. Briefly, the installation procedures and characteristics of the wells should be as follows.

The well bore should be advanced initially through the shallow aquifer using mud rotary techniques until "clean" materials are encountered in the underlying formation. The underlying formation may be assumed to be clean if no indications of the contamination are detected through visual examination of the soils, with the olfactory senses, or with field instruments. A sample from the terminus of this initial boring shall be analyzed in the laboratory to confirm that it was free of contamination.

The well bore should then be sealed off with a large diameter (6 inches or more) steel casing cemented into place with non-shrink, bentonite cement grout. Once the grout has set (24 hour minimum) and the well bore inside the surface casing has been thoroughly cleaned, the well bore should be advanced further employing a pure, high sodium bentonite mud of sufficient consistency and weight (approximately 120 percent the density of water) to ensure that its density is greater than the density of any known contaminants at the South Cavalcade Street Site. Frequent mud changes and cleaning of the downhole equipment will further minimize the potential for inadvertently transporting contaminants downward. Soil samples should be collected a 5 foot intervals to 50 feet, at 10 foot intervals thereafter, and at each change in materials; all samples shall be handled and stored as described in Subtask 2D including headspace analyses and other testing in the field and laboratory. Samples of the material immediately above, within, and immediately below the target horizon shall be analyzed in the laboratory to confirm field observations. The surface casing may also function as the protective casing for the well.

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The well casing and screen shall have a minimum nominal diameter of four inches and shall be constructed of Schedule 80 PVC or fiberglass. The screen shall be factory manufactured, with openings of 0.010 inches. All joints shall be screw threaded or riveted; no welded joints may be used. The well casing and screen shall be thoroughly steam cleaned prior to installation.

The entire interval of the deeper aquifer shall be screened. The screened interval of the well, to two feet above the top of screen, shall be packed with clean, suitably graded material to facilitate hydraulic communication between the well and the formation and to prevent clogging of the well screen with fine particles. A five foot bentonite seal shall be placed above the screen pack and the remainder of the borehole, to the ground surface, grouted with non-shrink bentonite cement grout. All drilling mud and cuttings shall be collected, containerized, and stored in compliance with RCRA (no permit required) for disposal onsite or at an approved facility.

Upon completion, and after the grout has been allowed to cure for a minimum of 24 hours, the well shall be developed to a sediment-free condition using a combination of air lifting, surge blocking, and pumping techniques. A sediment-free condition shall be defined as not more than 0.01 ml of sand collected in a 1000 ml Imhoff cone when sampling 1 to 2 minutes after pumping commences. The maximum total development time shall be 10 hours.

excluding nonpumping or nondeveloping intervals longer than 15 minutes. Once free of apparent sediment, the well shall be pumped for a minimum of eight hours at 10 gallons per minute, or the equivalent volume of water. Water produced by completion or purging must be collected, containerized, and stored in compliance with RCRA (no permit required) for proper disposal.

B. Water Level Measurements: Measurement of water levels in the deeper aquifer shall be made no sooner than one week nor more than one month after installation of the wells. Thereafter, water levels in the wells should be measured on a quarterly basis and at each time samples are obtained for analyses of water quality. All downhole measuring equipment shall be properly cleaned prior to use.

C. Groundwater Sampling: The groundwater in the deeper aquifer shall be sampled approximately one month after installation of the wells and again approximately three months later. Prior to sampling, a minimum of ten casing volumes of groundwater shall be removed from the well; this shall be stored and disposed of as previously described.

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Sampling Localities -- Based on available information, installation of two deep wells into the deeper aquifer in the southeast and southwest corners of the site are considered adequate (Figure 4-3). These wells, in addition to the existing well in the northern portion of the site, should be sufficient to confirm the quality of water in the deeper aquifer and to provide a basis for determining whether additional wells are needed. These wells may not be sufficient to allow determination of the basic hydrology of the deeper aquifer, however.

Analyses --

Analyses of groundwater samples from the deeper aquifer shall be for the following:

Field Analyses	Method No.
1) pH	150.1
2) Conductivity	120.1
3) Temperature	170.1

Laboratory Analyses[a]	Method No.
1) Volatile Organics; Library search[b]	624
2) Acids Fraction; Library search[c]	625
3) Bases/Neutrals; Library search[c]	625
4) Priority Pollutant Metals	200.2
5) Cyanide	335
6) Iron	236
7) Nitrate	300
8) Pesticides and PCB's	608

[a]All laboratory analyses are to be performed by a laboratory experienced and equipped to handle high hazard materials.
[b]The library search is to identify up to 10 compounds with concentrations greater than 10 percent of internal standards.
[c]The library search is to identify up to 20 compounds from the acids/bases/neutrals fractions with concentrations greater than 10 percent of internal standards.

Complete analyses, as described above, shall be performed on the first round of deep groundwater samples. For the second round, the only changes permitted are elimination of the analyses for nitrate and iron, with EPA approval.

Analyses of the selected soil samples shall be for the following:

Laboratory Analyses[a]	Method No.
1) Acids and Base/Neutral Fraction Mix (Capillary GC/MS)	8270
2) Zinc, copper, chromium, lead	6010
3) Arsenic	7061
4) Cyanide	9010

[a]All laboratory analyses are to be performed by a laboratory experienced and equipped to handle high hazard materials.

If further groundwater sampling is required after two rounds, selected parameters may be eliminated from the analyses with EPA approval.

Deliverables --

1) Well logs and completion records for the wells into the deeper aquifer
2) Documentation of the disposition of all water produced during development and sampling of the deeper wells
3) Copies of the field notebook of the supervising geologist or engineer
4) Field analyses results
5) Analytical laboratory results
6) Copies of the chain of custody forms

Contingency -- Should contamination of the deeper aquifer be found, installation of one or more additional wells shall be required, as shall determination of the fundamental hydrologic behavior of the deeper aquifer system. In addition, installation of one or more wells to the next deeper aquifer may be required, as well as documentation of its use, hydrology, and quality. Monitoring beyond the one year period specified above may also be required. Furthermore, if the analytical results of soils materials indicate the presence of pentachlorophenol at concentrations greater than 1000 ppm, further field investigations sh uld cease immediately, and the scope of work reevaluated and revised. In all cases, the review and guidance of EPA shall determine whether additional sampling, additional wells, additional analyses, or monitoring over a more extended period shall be required.

SUBTASK 2F - NONSOIL MATERIALS INVESTIGATION

Objectives -- To determine the character and degree of contamination, if any, of non-soil material encountered on the South Cavalcade Street Site to facilitate evaluation of the disposition of these materials.

Methodology -- Non-soil materials encountered on the South Cavalcade Street Site that are related to past wood treating and wood preserving operations on the site or that appear to be abandoned and not directly under the control of or attributable to the current land owners shall be examined, characterized and sampled for indications of contamination using appropriate techniques.

Sampling Localities -- No specific sampling localities have been identified. The need to perform this subtask is dependent on the results of the previously performed Field Investigation subtasks.

Analyses -- Analyses of non-soil materials shall be sufficient to determine the nature and the extent of their contamination and to assess the most feasible method of disposing of the materials. Engineering judgment is necessary in selecting the tests and analyses to be performed.

Deliverables --

1) Complete descriptions of all non-soil materials encountered on the site
2) A map depicting the locations and extent of non-soil material encountered on the site
3) Analytical laboratory results
4) Copies of the field notes of the supervising geologist or engineer
5) Copies of the chain of custody forms

Contingency -- The review and guidance of EPA is essential in addressing the occurrence and contamination of non-soil materials encountered on the South Cavalcade Street Site. Consultation with EPA is required in assessing what tests are necessary and whether exploration to completely determine the extent and degree of contamination of non-soil materials is necessary. If the analytical results indicate the presence of pentachlorophenol at concentrations greater than 1000 ppm, further field investigations should cease immediately, and the scope of work reevaluated and revised with EPA guidance.

SUBTASK 2G - AIR QUALITY INVESTIGATION

Objectives -- To ascertain whether air emissions associated with contamination on the South Cavalcade Street Site pose a hazard, either in their current state on the site, or in the event of their removal.

Methodology -- Air quality analyses shall be a routine part of all invasive field investigations (Subtasks 2B, 2D, 2E, and 2F) through use of field monitoring instruments. These analyses should assist in characterization of the air emissions at the South Cavalcade Street Site and in assessing whether removal of the contaminants on the site would constitute a hazard. Background air quality may be obtained using Tennax tube samplers for volatile organics. Samples should be collected over a two-hour time interval on three consecutive days. On each day, one upwind sample and two downwind samples should be collected. All samples shall be collected in duplicate.

Analyses -- Thermal desorption (GC/MS) for volatile organics; procedure is not EPA approved, but EPA development documents are available.

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Deliverables --

1) Laboratory analyses
2) Chain of custody forms
3) Memorandum describing collection procedures and sampling localities and sampling times.

Contingency -- Should severe and extensive air emission hazards be encountered on the South Cavalcade Street Site, additional air quality studies shall be necessary. These might include, but not necessarily be limited to, installation of one or more air quality sampling stations and excavation of test pits for the purposes of investigating the emissions that might occur if soil or non-soil contaminants are removed.

4.2.4 TASK 3 - PERFORM ENDANGERMENT ASSESSMENT

Objective -- To conduct an endangerment assessment to establish the extent to which contaminants present at the site or released from the site may present a danger to the public health, welfare, or the environment. The endangerment assessment should evaluate conditions at the site in the absence of any further remedial actions, i.e., it will constitute an assessment of the "No-Action" remedial alternative. The endangerment assessment shall be conducted consistent with the EPA draft guidelines and will be detailed enough to conform at least to EPA's "Level II" Endangerment Assessment.

Methodology -- The following factors shall be considered through the performance of eight subtasks:

- Determine contaminants found at the site
- Ascertain factors affecting migration
- Assess environmental factors
- Evaluate exposure
- Evaluate toxicity
- Determine environmental impacts
- Determine data gaps and recommendations
- Quality assurance

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SUBTASK 3A - DETERMINE CONTAMINANTS FOUND AT THE SITE

Information on the identity, quantity, form, and concentrations of contaminants found at the site should be summarized in tabular and or graphic form and should be used as the basis for the transport and exposure models outlined below. Specifically, data on source strengths and ambient concentrations in soil, groundwater, surface water, existing seeps, and air, should be summarized. Special attention should be paid to the reliability of analytical data, and the tabulations should ordinarily be limited to data validated by acceptable QA/QC procedures.

A short list of contaminants of primary concern for hazard evaluation should be compiled. This list should include, at a minimum, polynuclear aromatic hydrocarbons (PAH's), arsenic, chromium, lead, and zinc. Any other contaminants found at or near the site during the RI should be screened for inclusion in this list. In particular, if creosols and priority pollutant phenolic compounds are found at or near the site during the RI, these should be given special attention in screening. The screening of contaminants shall be based on quantities present, potential for exposure, and toxicity (using toxicity indices such as ambient water quality criteria or unit risks). This information should be used to derive a hazard index to permit comparison and ranking the relative hazards posed by each chemical found during the RI with those of PAH's and the metals listed above. Based on this ranking, a short list of contaminants of primary concern should be compiled and a preliminary report prepared for review by EPA and EPA's technical consultants. After approval of the short list by EPA, the remainder of the endangerment assessment may be limited to consideration of the chemicals on the short list.

SUBTASK 3B - ASCERTAIN FACTORS AFFECTING MIGRATION

Information on topography, soil environment, geological environment, hydrological characteristics, and climate generated during the RI should be summarized to serve as the basis of exposure models, as discussed below.

SUBTASK 3C - ASSESS ENVIRONMENTAL FATE OF CONTAMINANTS

Physical and chemical characteristics of contaminants should be derived from standard sources and should be used to characterize the environmental persistence of each chemical, as well as it propensity to migrate in various media and to transfer from one medium to another. Specifically, a detailed evaluation should be made of the persistence and mobility of PAH's in soils under the conditions prevailing at the site, including their tendency to be sorbed to soils and other materials present at the site, and their tendency to leach into groundwater. The last evaluation should take into account the presence of hydrocarbons, phenols or other solvents that may increase leachability. This evaluation should take into account, to the extent possible, differences in physical and chemical properties among different species of PAH's and should evaluate the potential for differential persistence or mobility of the more toxic species. A similar evaluation should be made of the mobility of compounds of arsenic, chromium, lead, and zinc (taking into account the chemical forms of these elements present at the site and prevailing conditions in soil and groundwater), and of any other contaminants included in the short list.

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This information should be used to generate models of contaminant migration from the site. Specific routes of contamination that should be modeled are the following:

1) Leaching of contaminants into shallow groundwater aquifers, followed by transport in shallow groundwater to points where groundwater discharges to surface water or to areas where groundwater may be withdrawn for industrial use or other purposes.

2) Percolation of contaminants into deep groundwater.

3) If the result of No. 2 above, or monitoring of the deep groundwater indicate the potential for or actual transport of contaminants into the deep groundwater, the subsequent transport of contaminants in the deep aquifer should be modeled in detail, with the specific goal of predicting concentrations of contaminants at future time periods in areas where the aquifer is used for a drinking water supply.

4) Surface run-off or erosion of soil particles into surface water drainage.

5) If the results of No. 4 above, or sampling of bayous off-site indicate the potential for or actual transport of contaminants into off-site surface waters, the fate of the contaminants in these waters should be modeled. These models should take into account dilution, degradation, spatial dispersion, biological uptake, and bioconcentration in food chains.

6) Offsite transport of soils excavated during remedial actions and for the proposed Metro facilities.

Other routes of transport that should be considered to the extent necessary to evaluate their potential significance include volatilization of PAH's or other organic contaminants, transport of airborne dust, and off-site tracking of contaminated soils by vehicles, humans, or animals. These routes

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need not be modeled quantitatively if semi-quantitative calculations show them to be unimportant for exposure of sensitive receptors.

The objective of modeling contaminant transport is to derive estimates of ambient concentrations of contaminants both onsite and off-site and hence to estimate exposure by human and wildlife receptors. The modeling should therefore be focused on areas where potential receptors have been identified and need not attempt to generate a detailed description of the movement of low levels of contaminants into remote areas.

SUBTASK 3D - EXPOSURE EVALUATION

In the first stage in exposure assessment, the populations at risk should be enumerated. For human populations, this should include a description of the number of distribution of residents and workers (both onsite and off-site), the demographic characteristics of the population, and projections for changes in future decades (obtainable from government and commercial sources). At the South Cavalcade Street Site, an evaluation should include the potential development of the site for a metro station and maintenance and storage yard. Use of the site by construction workers, future maintenance yard workers, and future Metro passengers should be summarized in detail. If transport of contaminants to deep groundwater is found likely to occur, the extent of likely use of the aquifer for drinking or other purposes should be assessed. Any specially sensitive populations (children, older persons, etc.) should be identified. If off-site transport of contaminants is found likely to occur, wildlife populations at risk should be defined using information from governmental and private surveys, supplemented by focused field investion if needed. EPA guidelines and current practices shall be followed in compiling and presenting this information.

In the second stage in exposure assessment, scenarios for exposure should be constructed. These scenarios should include at a minimum the following:

- Direct contact with contaminated surface soils by present or future users of the site;

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- Direct contact with contaminated subsoils during future construction projects, including contact with such soils after their excavation and off-site or onsite disposal;
- Direct contact with contaminated surface soils following off-site transport by surface runoff, erosion, or tracking;
- Direct contact with contaminated shallow groundwater resulting from surface infiltration, industrial use, etc.
- Ingestion of contaminated drinking water from the deep aquifer;
- Consumption of contaminated fish or shellfish following runoff into neighboring bayous or other surface waters.

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SUBTASK 3E - EVALUATE TOXICITY

A detailed summary of the toxicity of each of the contaminants on the short list should be prepared. These toxicity summaries should utilize the reviews in EPA's Ambient Water Quality Criteria (AWQC) documents published in 1980 as the initial basis for evaluation and should be supplemented with more recently-published information on toxicity and human health effects. For carcinogenic chemicals (including specifically PAH's, arsenic, and chromium), the toxicity summaries should refer to subsequent updated assessments by EPA's Carcinogen Assessment Group (CAG). Computerized literature searches should be conducted to identify any more recent studies that may require consideration and/or modification in hazard assessment.

Quantitative assessment of toxic hazards at predicted levels of exposure should follow current EPA procedures. For noncarcinogenic chemicals, exposure data should be compared to established "no-observed-adverse-effects-levels" (NOAELs) to estimate margins-of-safety. For carcinogens, exposure data should be combined with estimates of "unit risks," which are calculated using the linearized, multistage dose-response model. In both cases, the variability or intermittency of exposure should be taken into account. The results should be compared and presenusing a matrix approach. Potential endangerment will be considered present if for any identifiable population group, the calculated population risks are greater than levels generally regarded as of concern (10^{-6} or 10^{-5}, depending on circumstances) or the margins-of-safety are less than those usually considered adequate.

The potential for synergistic effects should also be evaluated. Accordingly, special attention should be paid to circumstances in which sequential exposure to chemicals might occur.

SUBTASK 3F - DETERMINE ENVIRONMENTAL IMPACTS

In addition to the brief description of any past incidents specified in EPA's outline, the likelihood that the chemicals released at the site will have substantial effects on vegetation or wildlife should be assessed by comparing the predicted ambient concentrations of contaminants with those known to be toxic to test species.

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SUBTASK 3G - DETERMINE DATA GAPS, RECOMMENDATIONS, AND QUESTIONS

This Subtask of the Endangerment Assessment should draw attention to data gaps and questions, and it should include recommendations for further site investigation, if necessary.

SUBTASK 3H - QUALITY ASSURANCE

The Endangerment Assessment shall be based exclusively on analytical data that have been subjected to approval QA/QC procedures, unless there is specific reason to make an exception (e.g., if invalidated or partially validated data are the only data available). In addition to QA/QC for the analytical data, the results of transport modeling, exposure assessment, and toxicity assessment shall be subject to Quality Assurance. This shall include, at a minimum review of the assessments by an independent scientist with qualifications and experience not less than those of the project manager, and independent checking of a 10% sample of calculations and citations.

Deliverables -- An Endangerment Assessment Report covering the results of performance of the eight subtasks.

4.2.5 TASK 4 - PREPARE DRAFT REMEDIAL INVESTIGATION REPORT

Objective -- To assemble into a single document, the results of the data collection activities, analyses, and evaluations and to characterize the South Cavalcade Street Site in terms of:

- The nature, source, and toxicity of the contamination associated with the South Cavalcade Street Site;
- The extent to which contaminants have migrated from th. site and the concentrations of those contaminants; and
- The environmental and health impacts of the contamination.

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The report shall include the following major section:

EXECUTIVE SUMMARY

1.0 INTRODUCTION
- 1.1 Site Background Information
- 1.2 Nature and Extent of Problem(s)
- 1.3 Overview of Report

2.0 SITE FEATURES
- 2.1 Geography
- 2.2 Demography
- 2.3 Land Use
- .
- .
- .

3.0 CLIMATOLOGY

4.0 HYDROLOGY
- 4.1 Groundwater
- 4.2 Surface Water
- 4.3 Flood Potential
- 4.4 Drainage
- .
- .
- .

5.0 GEOLOGY

6.0 SOILS

7.0 HAZARDOUS SUBSTANCES
  7.1 Waste Types, Composition, and Characteristics
  7.2 Environmental Concentrations
    7.2.1 Air
    7.2.2 Groundwater
    7.2.3 Surface Water
    7.2.4 Soils
    7.2.5 Biota

8.0 PUBLIC HEALTH AND ENVIRONMENTAL CONCERNS
  8.1 Potential Receptors
  8.2 Public Health Impacts
  8.3 Environmental Impacts

9.0 MANAGEMENT CONSIDERATIONS
  9.1 Disposal Practices
  9.2 Regulations
  .
  .
  .

REFERENCES
APPENDICES

Deliverables -- The Draft Remedial Investigation Report; for EPA review and comment.

4.2.6 TASK 5 - PREPARE FINAL REMEDIAL INVESTIGATION REPORT

Objective -- Incorporation of review comments by EPA into the Remedial Investigation Report.

Deliverables -- The final Remedial Investigation Report for the South Cavalcade Street Site.

4.3 FEASIBILITY STUDY

4.3.1 OBJECTIVE

The objectives of the Feasibility Study are to formulate and evaluate the feasibility of all possible remedial alternatives for the South Cavalcade Street Site in terms of their technical feasibility, implementability, public health risks, environmental effectiveness, institutional requirements, and costs; and by screening and evaluating the alternatives, reduce

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the range of possibilities to one or more that appear to be the most cost-effective. The principal goals are to recommend a remediation action that encompasses the optimum combination of environmental benefit, ease of design and construction, institutional preference and cost. Specific tasks to be performed as part of the Feasibility Study are presented below.

4.3.2 TASK 6 -- DEVELOP REMEDIAL ALTERNATIVES

SUBTASK 6A - ESTABLISH REMEDIAL RESPONSE OBJECTIVES

Objective -- To establish a set of site-specific remedial response objectives based on public health and environmental concerns and information obtained during the Remedial Investigation.

Methodology -- Site-specific information for the South Cavalcade Street Site obtained from review of the historic data, from the field investigation program, and from the endangerment assessment should be consolidated and evaluated to formulate a set of site-specific objectives for remedial response. Basic guidance should be obtained from Section 300.68 of the National Contingency Plan (NCP), 40 CFR 264 (RCRA), EPA's interim guidance documents, and the requirements of other federal, state and local regulations. Objectives for source control measures should be developed to prevent or significantly minimize migration of contaminants from the site. Objectives for off-site measures must prevent or minimize the impacts of contamination that has migrated from the site or from a disposal facility in which the contaminants will be placed. Consultation with EPA Region VI should be an ongoing process in establishing the remedial response objectives.

Deliverables -- A memorandum report briefly presenting the response objectives and detailing the statutory and precedential backup.

SUBTASK 6B - IDENTIFICATION OF REMEDIAL ALTERNATIVES

Objective -- To develop a limited set of potential remedial alternatives for source control and/or off-site remedial actions.

Methodology -- The set of remedial alternatives that have already been developed should be refined, reduced, or augmented, as necessary, in consideration of the information obtained during the field investigations on the adjacent to the South Cavalcade Street Site and the endangerment assessment. These alternatives shall incorporate the remedial response objectives established above, but also shall include a no action and one or more options in which cleanup is not mandated. At least two of the alternatives shall be consistent with relevant public health and environmental standards, including RCRA: one for an onsite alternative, and one for an off-site alternative. The other alternatives should include those that exceed applicable public health and environmental standards and those that do not attain applicable or relevant standards, but reduce the likelihood of current or future harm from the contaminants. In the latter case, one or more alternatives should be included that closely approach the level of protection provided by the relevant standards, but do not achieve those standards. As before, the remedial alternative should be directed toward components of the environment: groundwater, surface water, soils, and non-soils materials.

Deliverables -- A set of remedial response alternatives for review and approval by EPA.

4.3.3 TASK 7 - SCREEN REMEDIAL ALTERNATIVES

Objective -- To eliminate remedial alternatives that are clearly not feasible or appropriate.

Methodology -- The list of remedial alternatives defined in Task 6, should be subjected to an initial screening using five broad considerations:

1) Alternatives that are or may prove to be extremely difficult to implement, will not achieve the remedial response objectives within a reasonable period of time, or included unproven or unreliable technology should be excluded.

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2) Alternatives posing significant adverse environmental effects should be excluded.

3) Alternatives that do not satisfy the response objectives and do not contribute substantially to the protection of public health and the environment should be eliminated. Source control alternatives must achieve adequate control. Off-site alternatives shall minimize or mitigate the threat of harm to public health, welfare, and the environment.

4) Alternatives that do not meet the technical requirements of applicable environmental laws (e.g., RCRA, CWA, TSCA, Safe Drinking Water Act, UIC) most likely should be excluded from further consideration. Additional state and local regulations shall also be addressed as well as known institutional preferences.

5) Alternative whose costs (order of magnitude capital costs and operation and maintenance costs) far exceed those of the other alternatives and that does not provide substantially greater public health or environmental benefits should probably be eliminated. Screening for costs shall be conducted only after screening related to public health and the environment has been performed.

Deliverables -- A memorandum summarizing the results of the screening process, the screening procedures, and the alternatives to be considered for detailed evaluation.

4.3.4 TASK 8 - PERFORM LABORATORY STUDIES/PILOT TESTING

Objective -- To obtain additional information pertinent to the remaining remedial alternatives through laboratory or bench-scale treatability studies or pilot testing. The goals are to evaluate uncertainties with respect to potential remedial measures and to establish engineering criteria for final design.

Methodology -- Additional field investigations, laboratory studies, or pilot testing needs shall be identified for the remedial alternatives remaining after the screening process. Prior to commencing the field investigations for the evaluation of the remedial alternatives, additional information may be needed, either because new alternatives have arisen or because special requirements. The benefits of combining, staging, or phasing the different components of a potential remedial action must be evaluated. Alternatives involving onsite treatment of surface water, groundwater, or soils and non-soil materials are likely candidates for pilot testing. The intent in performing this task is to delineate the requirements, devise the needed procedures, and initiate testing for those alternatives that are clearly viable, while the screening and evaluation of remedial alternatives (Tasks 7 and 9) is in progress. In this way, the Feasibility Study should not be unduly delayed.

Deliverables -- Memorandum report summarizing the tests performed, the testing procedures and the test results.

4.3.5 TASK 9 - EVALUATE REMEDIAL ALTERNATIVES

Objective -- To evaluate the remedial alternatives remaining after the initial screening (Task 7), incorporating preliminary or final results of the laboratory or pilot testing (Task 8) and any modeling performed as part of the endangerment assessment. The goal is to arrive at a recommendation of the most cost-effective remedial alternative or combinations of alternatives for remedial action at the South Cavalcade Street.

Methodology -- The detailed evaluation of remedial alternatives shall be carried out by performing six subtasks:

SUBTASK 9A - DETAILED DEVELOPMENT OF REMEDIAL ALTERNATIVES

Each remedial alternative should be developed in detail through consideration of the factors found in 300.68(f) through (j) of the NCP and at a minimum shall include:

- Description of appropriate treatment and disposal technologies.
- Special engineering considerations required to implement the alternatives (Input to Task 8).
- Environmental impacts and proposed methods for mitigation of those impacts, including costs.
- Operation, maintenance, and monitoring requirements of onsite remedies.
- Off-site disposal and transportation requirements.
- Temporary storage requirements.
- Staging requirements or capabilities.
- Capability for segmenting the remedial action.
- Safety requirements for implementation of the remedial action (on-site and off-site).
- Compliance of off-site alternatives with RCRA and state and local regulations.

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SUBTASK 9B - TECHNICAL ANALYSIS

Each remedial alternative shall be evaluated for technical feasibility, including reliability, implementability, and safety considerations.

- Reliability: Reliability shall be evaluated based on effectiveness and durability. Effectiveness relates to the degree to which a remedial alternative can accomplish its design objectives. Durability is a function of the projected length of time that the effectiveness can be maintained. Each remedial alternative should incorporated proven technologies that have a demonstrated, dependable record of use and that are capable of accomplishing the desired corrective results over the planned life of the remedial action; operations, maintenance, and monitoring requirements should be specified. The evaluation of effectiveness and reliability will be in relative terms; alternatives that minimize or eliminate the potential for further or future releases of contaminants to the environment are considered more effective and reliable than those that do not have the same capability.

- Implementability: Implementability shall be based on whether an alternative has been employed successfully at one or more other sites that are similar to the South Cavalcade Street Site or whether research and development has been successfully completed. Factors to be considered in assessing implementability include ease of design and construction, the capability for phasing or segmenting the remedial action into operable units and discrete areas of the site, and special engineering requirements.

- Safety: The safety of a remedial alternative is a reflection of the security and freedom from risk, loss, injury, harm, or danger. Major risks are from fire, explosion, and exposure. The scope of safety considerations encompasses those living in the community around the state and those working on the site, either in implementing the remedial action or in subsequently operating and maintaining it. Safety considerations also include risks associated with failure of the remedial alternative.

SUBTASK 9C - INSTITUTIONAL LEGAL/POLICY ANALYSIS

The endangerment assessment described in Task 4 of the Remedial Investigation constitutes the environmental and health assessment of the "No Action" remedial alternative. For each of the remedial alternatives being considered in Task 9 of the Feasibility Study, a parallel exposure assessment shall be performed to evaluate the extent to which the alternative reduces or eliminates the endangerment to public health, welfare, and the environment. Thus, for each alternative, the extent that the proposed action reduces or eliminates the propensity for the contaminants to migrate should be determined. The results can then be used to calculate the extent to which exposure (and hence risk) is reduced via exposure pathways. The results should be presented in tabular or matrix format to facilitate comparison among various alternatives. Alternatives that will fail to reduce public health risks to acceptable levels shall be identified.

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SUBTASKS 9D - ENDANGERMENT ASSESSMENT

For each alternative remaining after initial screening, the environmental effects shall be compared. Adverse impacts need to be evaluated only within the individual scope of each alternative. However, as described in Section 3.4.4, detailed assessments may not be required for all alternatives. In these cases, it is assumed that no adverse environmental affects will be caused by implementation of the alternative plan. Known environmental impacts of each alternative should be compared to the environmental effects caused by the no action alternative and with other alternatives with recognizable environmental impacts. Alternatives that fail to meet applicable environmental standards and criteria shall be identified.

SUBTASK 9E - INSTITUTIONAL/LEGAL POLICY ANALYSIS

Institutional concerns include such factors as zoning and right-of-way requirements, transportation restrictions, discharge and construction permits, worker health and safety issues, and other aspects of existing federal, state, and local regulations that might bear on the South Cavalcade Street Site. Superfund remedial actions must achieve the functional equivalency to NEPA actions. Institutional concerns also include coordination with federal, state, and local agencies and institutional requirements, safeguards, and preferences in implementing the remedial action. These concerns shall be addressed.

SUBTASK 9F - COST ANALYSIS

The costs of each remedial alternative remaining after the initial screening (Task 7) shall be evaluated as a present worth cost, including total capital costs and annual operating and maintenance costs for the life of the project. In developing these costs, the following steps shall be performed:

- Estimate capital costs and annual operating and maintenance costs
- Calculate the stream of payments and present worth

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- Evaluate the risks and uncertainties in the cost estimates; estimates should be within =50 and -30 percent of the actual costs
- Identify input data and reliability necessary to evaluate the cost effectiveness of the remedial alternatives

These data can then be arranged in a tabular format to facilitate evaluation of the alternatives.

SUBTASK 9G - SUMMARY OF ANALYSES AND RECOMMENDATIONS

The purpose of this Subtask is to bring together in a succinct summary the results of the detailed evaluations performed in the previous five subtasks (technical feasibility, public health, institutional, environmental, and costs) and to recommend the most cost-effective remedial alternative. The recommendation shall be justified by comparison of the relative advantages and disadvantages of the recommended alternative as compared to the other alternatives evaluated, including the extent to which the remedial alternatives meet the technical requirements and environmental standards of applicable environmental regulations. To the extent possible, evaluation criteria and considerations shall be applied uniformly to each of the remedial alternatives; special consideration will be addressed where necessary. The most cost-effective alternative shall be the alternative with the lowest present work cost that is technically feasible and that adequately protects or mitigates the damages to public health, welfare, and the environment.

Deliverables -- The deliverables for Task 9 include an oral briefing to EPA on the completion of the remedial alternatives evaluation. The remedial alternatives evaluated, the evaluation procedures, and the results shall be detailed in the briefing as should the justification for selecting the recommended alternative. The summary table prepared in Subtask 9F should provide the basis for the briefing.

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4.3.6 TASK 10 - DEVELOP CONCEPTUAL DESIGN

Objective -- To prepare a conceptual design for the recommended remedial alternative.

Methodology -- A conceptual design shall be prepared for the recommended remedial alternative. The conceptual design should include, but will not be limited to the following:

- General engineering approach
- Implementation schedule
- Special implementation requirements
- Institutional requirements
- Phasing and segmenting capabilities and requirements
- Preliminary design criteria
- Preliminary site and facility layouts
- Estimated costs
  - -- Capital costs
  - -- Operations and maintenance costs
- Operating and maintenance requirements
- Safety requirements for implementation
  - -- Off-site
  - -- Onsite
  - -- Costs of implementation
- Additional information as needed

Deliverables -- Memorandum report describing the recommended remedial alternative and presenting the conceptual design.

4.3.7 TASK 11 - PREPARE DRAFT FEASIBILITY STUDY REPORT

Objective -- To present the results of the feasibility study; Tasks 6 through 9.

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Methodology -- A draft Feasibility Study Report shall be prepared summarizing the results of Tasks 6 through 9. The report shall include the following major sections:

- 0.0 Executive Summary
- 1.0 Introduction
  - 1.1 Site background
  - 1.2 Nature and Extent of Problem
  - 1.3 Objectives of Remedial Action
- 2.0 Screening of Remedial Action Technologies
  - 2.1 Technical Criteria
  - 2.2 Environmental and Public Health Criteria
  - 2.3 Institutional Criteria
  - 2.4 Other Screening Criteria
  - 2.5 Cost Criteria
  - 2.6 Remedial Action Alternatives Development
- 3.0 Remedial Action Alternatives
  - 3.1 Alternative 1 (No Action)
  - 3.2 Alternative 2
  - 3.n Alternative n
- 4.0 Results of Laboratory/Pilot Tests
- 5.0 Analysis of Remedial Alternatives
  - 5.1 Non-Cost Criteria
    - 5.1.1 Technical Feasibility
    - 5.1.2 Environmental Feasibility
    - 5.1.3 Institutional Requirements
    - 5.1.4 Endangerment Assessment
  - 5.2 Cost Analysis
- 6.0 Summary of Remedial Alternatives
- 7.0 Recommended Remedial Alternative
- References
- Appendices

Deliverables -- Ten bound copies of the draft Feasibility Study Report.

4.3.8 TASK 12 - PREPARE FINAL FEASIBILITY STUDY REPORT

Objective -- To incorporate review comments from EPA on the draft Feasibility Study Report into a final Feasibility Study Report.

Deliverables -- Ten bound copies of the final Feasibility Study Report. The contents shall be the same as the draft Feasibility Study Report with the exception that an additional section responsive to the review comments shall be included.

4.4 ADDITIONAL REQUIREMENTS

4.4.1 TASK 13 - PERFORM EPA DESIGNATED ACTIVITIES

Objectives -- To assist EPA in presenting the results of the Remedial Investigation/Feasibility Study effort and to assist in the development of a Record of Decision.

Methodology -- On an as needed basis, fact sheets, site diagrams, and other information shall be prepared at the request of EPA for presentation at meetings. In addition, assistance shall be provided to EPA a needed in preparing the Record of Decision through preparation of technical information, and attendance at meetings.

Deliverables -- Technical support, assistance, and attendance at meetings, as required.

4.4.2 TASK 14 - PROJECT MANAGEMENT

Objective -- To maintain effective communications with EPA on the technical and financial progress of the Remedial Investigation and the Feasibility Study.

Methodology -- The scope of this task is discussed in Section 5 of this Work Plan.

Deliverables -- Summaries of meetings; monthly reports.

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5.0 PROJECT MANAGEMENT

5.1 ORGANIZATION

The project management organization of the South Cavalcade Street Site RI/FS shall be designed to provide a clear line of functional and program responsibility and authority, supported by a management control structure. Basically, this control structure should provide for:

- Clearly identified lines of communication and coordination
- Monitoring of program budget, schedules and financial performance
- Managing key technical resources
- Providing periodic financial management and progress reports
- Health and Safety
- Quality Control

The project team should be composed of managers and technical specialists who can fulfill, at a minimum, the following project roles:

- Technical Advisor
- Project or Site Manager
- Quality Assurance Coordinator
- Health and Safety Officer
- On-site Coordinator
- Technical Specialists in the fields of
  - Hydrogeology
  - Chemistry
  - Engineering
  - Toxicology
  - Industrial Hygiene
  - Air Quality

An organizational chart for the RI/FS project team is shown in Figure 5-1.

The management staff will be directly responsible for the execution of all field and analytical activities conducted in support of all hazardous waste

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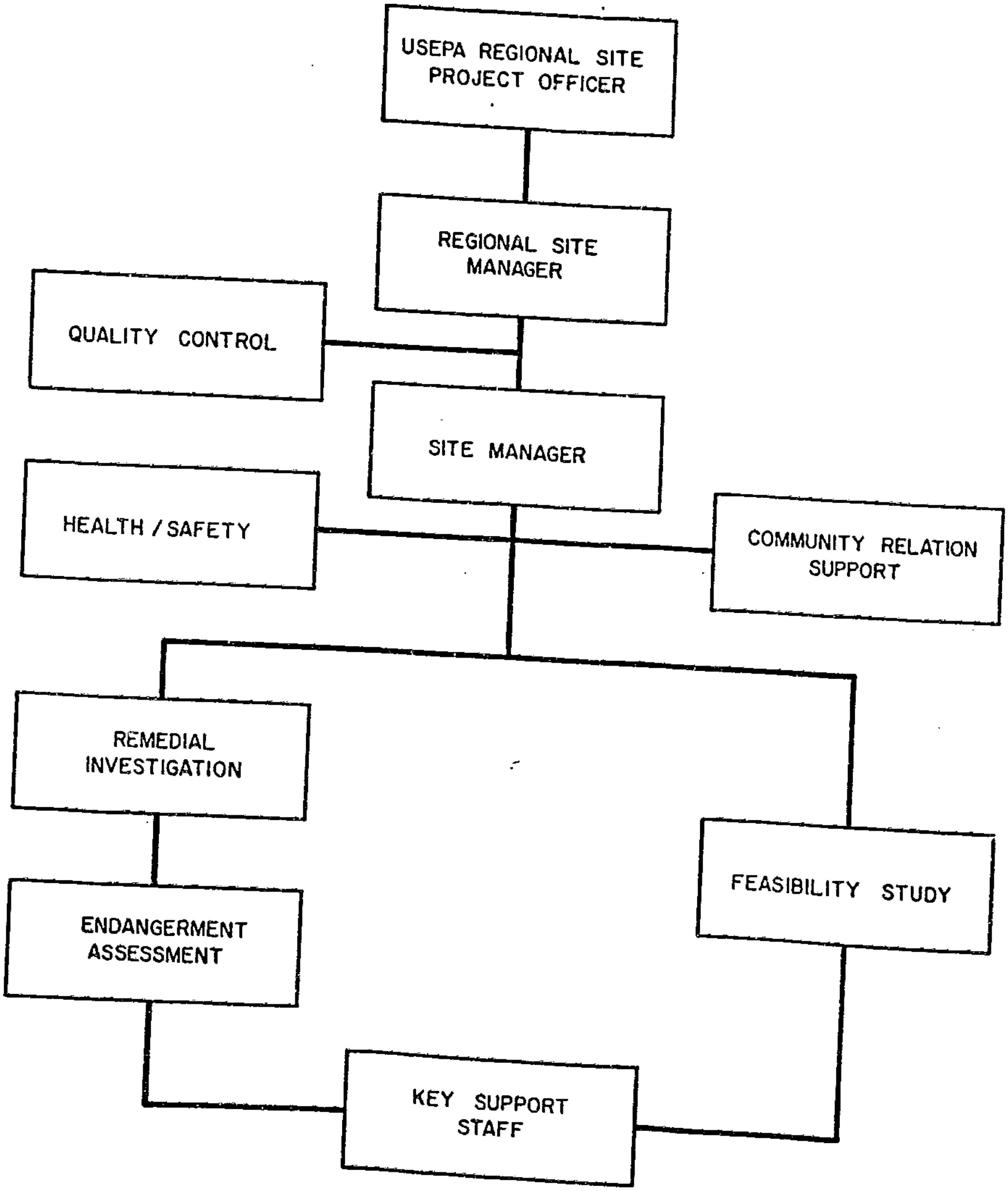
SOUTH CAVALCADE STREET SITE



PROPOSED PROJECT ORGANIZATION CHART

FIGURE 5-1.

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site investigations and for ensuring that these activities are carried out in strict compliance with the Quality Assurance and Health and Safety Policies described in the PRP's Project Operations Plan.

For the purposes of the field investigations program outlined herein, the onsite coordinator (or equivalent) should be delegated responsibility for the coordination and execution of the onsite field activities outlined in Section 4.0 of this work plan. It is the onsite coordinator's responsibility to ensure that all field investigation tasks are conducted in strict compliance with the PRP's Project Operations Plan. In this capacity, all onsite field personnel will report directly to the onsite coordinator for all matters directly relating to the field investigation. In addition, all onsite field personnel should be trained in proper health and safety procedures, equipment operation, and field sampling techniques, and be thoroughly familiar with Quality Control procedures.

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Subcontractor personnel providing servies in support of this project will perform such work in strict compliance with the appropriate contract specification for the activity. Responsibility for the health and safety of subcontractor personnel will rest directly with the subcontractor.

It will be the responsibility of the Senior Geologist or Engineer to ensure that the work performance of subcontractors is consistent with all aspects of the relevant contract specifications including health and safety. Any observed significant variance that is not expeditiously corrected by the subcontractor shall be brought to the immediate attention of the Project Manager or the Health and Safety Officer, as appropriate.

5.2 DELIVERABLES

A comprehensive list of deliverables which will be submitted to the EPA is shown in Table 5-1. The schedule for submittal of deliverables is also shown in this table.

TABLE 5-1
LIST AND SCHEDULE OF DELIVERABLES FOR THE SOUTH CAVALCADE STREET RI/FS

TASK	SUBTASK	DELIVERABLES	WEEK DUE FROM PROJECT BEGINNING
0		Work Plan, Interim Site Characterization Report, POP, Site Plan	6
	0A	Health and Safety Plan	
	0B	Quality Assurance and Quality Control Plan	
	0C	Site Specific Field and Analytical Plan	
	0D	Site Management Plan	
1	1A	Addenda to the Site Plans and Interim Site Characterization Report	8
	1B	Addenda to the Site Plans and Interim Site Characterization Report	
	1C	Site Survey w/topography (base map) and overlays of current facilities and utilities of 1" = 100' as addenda to Interim Report on Existing Information and Site Plans	
	1D	Detailed documentation of wells occuring in the vicinity of the site. 1 mile radius of site if on public record; one quarter mile radius of site if no public record.	
2	2A	1) Results from field study and 2) laboratory analyses, 3) chain of custody forms, 4) memorandum of field activities with field techniques documented.	36
	2B	1) Results from laboratory analyses, 2) chain of custody forms, 3) memorandum of field activities with field techniques documented.	
	2C	1) Contour and isopach maps and stratigraphic profiles and 2) memorandum with alterations/modifications of subsurface boring/well installation programs as deemed necessary.	
	2D	1) Borehole logs w/USC, blow counts, static water levels, 2) results of chemical analyses, 3) results of geotechnical analyses, 4) copies of field notes of supervising geologist/engineer.	
	2E	1) Well logs and completion records for all newly installed shallow wells, 2) documentation of the volume and disposition of all water removed from the wells, 3) copies of field notes of supervising geoloist/engineer, 4) water level measurements and interpretations of water table, 5) analytical laboratory results, 6) chain of custody forms (copies), 7) raw data and results of all aquifer tests.	

TABLE 5-1 (CONTINUED)

TASK	SUBTASK	DELIVERABLES	WEEK DUE FROM PROJECT BEGINNING
	2F	1) Well logs and completion records for deep wells, 2) documentation of disposition of all water produced during development and sampling of deeper wells, 3) copies of field notes of supervising geologist/engineer, 4) analytical laboratory results, 5) chain of custody forms (copies).	
	2G	1) Descriptions of non-soil materials encountered on site, 2) map of locations and extent of these materials, 3) analytical laboratory results, 4) copies of field notes of supervising geologist/engineer, 5) chain of custody forms (copies).	
3	--	Endangerment Assessment	38
4	--	Draft Remedial Investigation Report	37
5	--	*Final Remedial Investigation Report for the South Cavalcade Street Site	45
6	6A	Memorandum report presenting response objectives and detailing statutory and precedential backup.	43
	6B	Set of remedial response alternatives.	
7	--	Memorandum of results of remedial alternatives screening process, screening procedures, and alternative considered for detailed evaluation.	47
8	--	Memorandum report of laboratory studies/pilot tests performed, testing procedures and test results.	55

*Monthly memorandum of financial/technical reports.

TABLE 5-1 (CONTINUED)

TASK	SUBTASK	DELIVERABLES	WEEK DUE FROM PROJECT BEGINNING
9	9A-E	--	
	9F	Tabular summary of evaluations of technological feasibility, institutional, public health, and environmental, and costs as a basis for oral briefing to EPA.	58
10	--	Memorandum report describing the recommended remedial alternative and presenting the conceptual design.	63
11	--	Ten bound copies of the draft Feasibility Study Report	68
12	--	Ten bound copies of the final Feasibility Study Report	78
13	--	Technical support, assistance, and attendance at meetings (as required)	As needed
14	--	Summaries of project progress meetings	As needed
	--	Progress Reports	Monthly

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5.3 REPORTING REQUIREMENTS

The project manager will prepare a monthly status (progress) report covering the technical and financial aspects of the work assignment. These reports will be submitted to EPA Regional Site Project Officer within 15 calendar days after the end of the reporting period. For consistency in presentations, the content of the monthly status reports will follow the format specified by the EPA.

The project manager will prepare a draft project report within the schedule specified in the work plan. Each report will contain an executive summary and be forwarded by cover letter. After receipt of comments from the EPA, a final report will be prepared and distributed. The project report will conform to reporting requirements specified by the EPA.

In addition to preparation of these deliverables, the project manager will attend all monthly progress meetings. Notifications to the EPA will be prepared concerning any modifications or amendments to the work plan and at completion of the project.

5.4 SCHEDULE

The schedule for conducting the RI/FS is shown in Figure 5-2. The entire project should take approximately 18 months to complete.

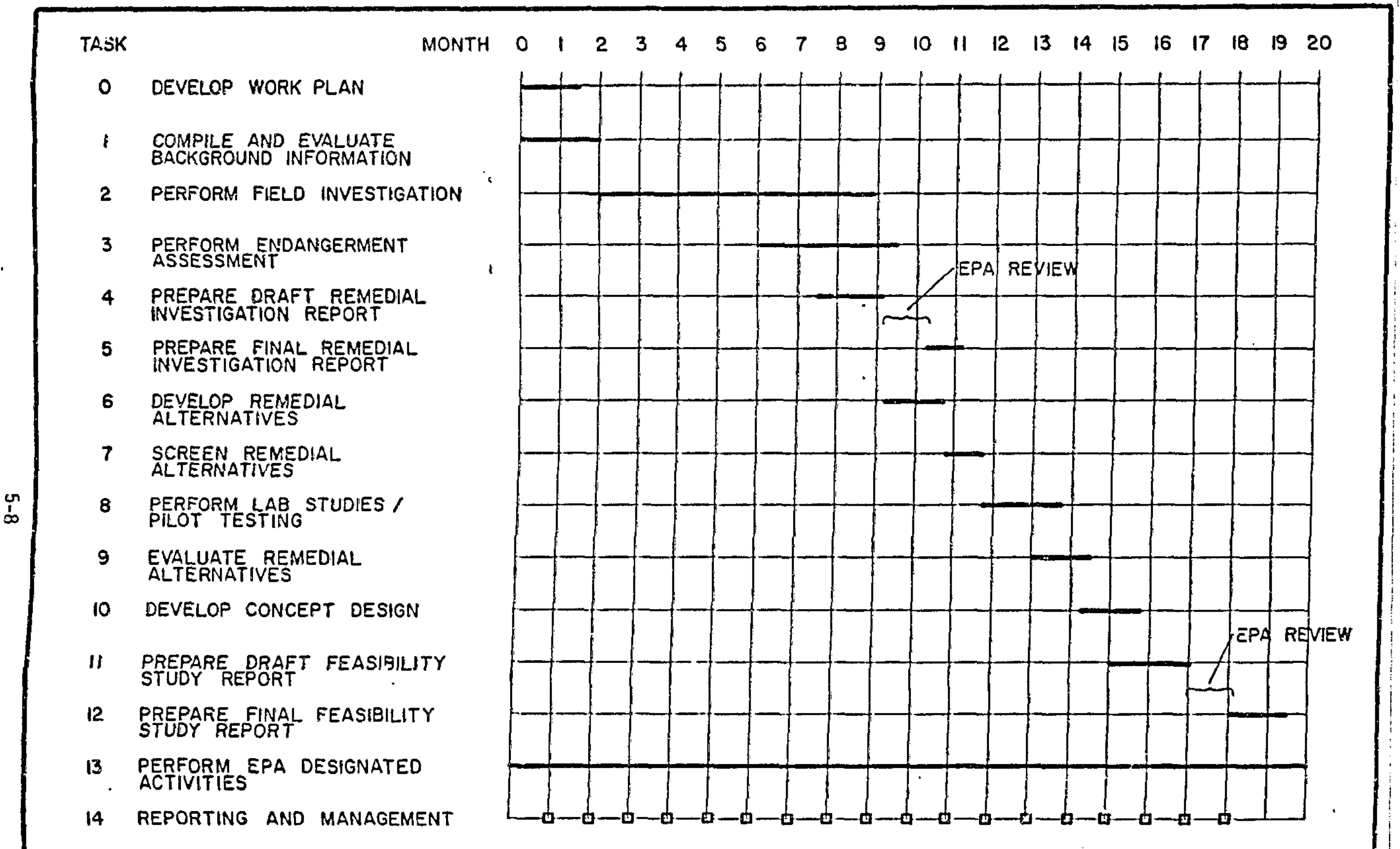

FIGURE 5-2.

PROPOSED PROJECT SCHEDULE FOR THE KOPPERS/CAVALCADE RI/FS

CAMP DRESSER & McKEE INC.